NAVAL POSTGRADUATE SCHOOL
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THESIS

THE DEVELOPMENT OF CAREER NAVAL OFFICERS FROM THE U.S. NAVAL ACADEMY: A STATISTICAL ANALYSIS OF THE EFFECTS OF SELECTIVITY AND HUMAN CAPITAL

by

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This research analyzes the United States Naval Academy's (USNA) admissions and professional development processes and their impact on the career development of its graduates in the Unrestricted Line (URL) communities. Three hypotheses are advanced to explain the high level of fleet performance and retention of USNA graduates: selectivity of applicants; Navy-specific human capital investment; and institutional favoritism. Non-linear LOGIT regression models for the USNA Classes of 1980 through 1985 are developed to analyze the influence of the hypothesed factors on the probability of a midshipman: (a) graduating from the USNA, and (b) developing into a career officer.

Both the USNA's composite "whole-person" and individual selection criteria play a significant role in the probability of graduation. Non-scholastic affective selection criteria, and both affective military performance and Navy-specific cognitive skill development at the USNA, are positively associated with the development of career officers. Additionally, several key predictors of career potential are identified. A paradigm shift in perspective from the current short-term context to a life-cycle career context is recommended in the "whole-person" selection and development of USNA midshipmen. .

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This research analyzes the United States Naval Academy's (USNA) admissions and professional development processes and their impact on the career development of its graduates in the Unrestricted Line (URL) communities. Three hypotheses are advanced to explain the high level of fleet performance and retention of USNA graduates: selectivity of applicants; Navy-specific human capital investment; and institutional favoritism. Non-linear LOGIT regression models for the USNA Classes of 1980 through 1985 are developed to analyze the influence of the hypothesed factors on the probability of a midshipman: (a) graduating from the USNA, and (b) developing into a career officer.

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I. INTRODUCTION

> *Education at a service academy is the first and most crucial experience of a professional soldier; and although attendance at a service academy is not universal for generals and admirals, the academies set the standards of behavior for the whole military profession.*[1]

A. BACKGROUND

The above observation by noted sociologist Morris Janowitz exemplifies the traditional school of western military thought. Military and naval academies in the United States, Europe, and Russia have throughout modern history produced the world's most outstanding and most successful military leaders.

This thesis explores the development of service academy graduates into professional military officers by focusing on the 152 year-old United States Naval Academy (USNA). While the USNA differs in many respects from its sister academies at West Point, Colorado Springs, and New London, all U.S. service academies are undergraduate four-year colleges which, despite offering a variety of majors, prescribe a technically-oriented general course of education in engineering, math and sciences, the humanities, as well as applicable professional military subjects. Indeed all the academies "bear a distinct family relationship to each other for they have a common mission, namely, to develop the qualities of character and intellect essential to their graduates' progressive and continued development as career officers of the

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[1] Janowitz, Morris. The Professional Soldier. New York: The Free Press, 1960. p. 127.

regular forces."[2]

While the world has changed greatly since the founding of West Point in 1802 And Annapolis in 1845, the roles of the U.S. service academies have not changed greatly. Though they now only produce a small percentage of newly commissioned officers, the ideal of the academy as the key, if not essential, first rung in the ladder towards a successful military career still exists.[3]

While several studies have questioned the academies' relevance and affordability in recent years of military downsizing, a recent study by Professor William R. Bowman at the USNA looks at the cost effectiveness of the service academies with more broadly defined career training costs and long-run economic returns, focusing on the Navy's officer corps. Within the context of the life-cycle analysis of long-term career performance, Bowman concludes that the USNA is the most cost-effective commissioning source of career officers. USNA graduates consistently display higher career retention and promotion rates than their peers from other commissioning services, making the marginal cost of producing a Navy Captain (O-6) from the USNA significantly lower than from any other commissioning source. (Bowman, 1995)

Further evidence as to the success of USNA graduates in the fleet is provided by a Navy Personnel Research and Development Center (NPRDC) study of active-duty Navy

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[2] Little, Roger. Handbook of Military Institutions. Beverly Hills, CA: Sage Publications, 1971. p.217

[3] USNA currently commissions approximately 30 percent of the Navy's URL officers, up from 15-18 percent during the Cold War build-up.

officers commissioned from 1972-1985. It found that the USNA graduates outperformed officers from other accession sources in retention and fitness report scores at every career point in almost every officer community. (Neumann and Abrahams, 1992)

This study extends these earlier studies by investigating the potential causes underlying the observed differential in officer performance. What is it about the service academies, their graduates, and the training they offer that explains this difference? How can an institution which produces only a minority of the military's new officers develop over half of its admirals and generals? Building on ideas developed by Bowman and focusing specifically on the USNA, this thesis proposes and investigates three alternative hypotheses for why the service academies are so successful in producing the military's top leaders.

First, the U.S. service academies are among the most selective undergraduate institutions in the country and in recent years have selected from roughly ten candidates for one appointment to an entering class. Thus, their inputs are of a higher quality than most American colleges and universities. This high degree of **selectivity** of the nation's "best and brightest" 17 to 21 year old men and women ensures that academy graduates will be among the "best and brightest" college graduates and junior military officers.

Secondly, the United States makes a substantial **human capital investment** in the training, development, and education of each academy graduate. The four-year service academy experience, which has been described as a "seminary-like" breeding ground for officers, not only offers a high quality undergraduate education, but also four years of military-specific professional training and military socialization. Thus, the academies' outputs are better prepared for the challenges of a military career. This intensive military-specific

human capital investment, which is estimated to cost $150,000 per midshipman at the USNA,[4] may well explain the superior officer performance of service academy graduates.

The third hypothesis is that an **institutional favoritism** exists in the services which significantly enhances the likelihood of career success for academy graduates relative to officers commissioned from other sources. Favoritism occurs if high-ranking officers who are service academy graduates select future generations of service academy graduates for prestigious assignments or promotion due to their allegiances to their alma mater regardless of their relative performance to their peers. In the case of the Navy, an elite naval aristocracy may consciously or unconsciously be driving this bias. Over the last thirty years the USNA has produced between 15 and 18 percent of the Navy's unrestricted line (URL) officers, yet "USNA graduates comprise 27 percent of the Navy captains and 54 percent of the admirals."[5] While Academy leadership point to this fact as a justification for its existence, such statistics warrant investigation into possible institutional bias. Such favoritism could be said to exist if Academy graduates were systematically promoted over equally (or more) qualified officers from other accession sources (OCS, NROTC).

To better illustrate these three hypotheses of naval officer development, the following conceptual model is proposed (Figure 1). This thesis will attempt to explain empirically the separate effects or impact of selectivity in admissions, human capital investment in

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[4] Smith, Marvin. Officer Commissioning Programs: Costs and Officer Performance. Congressional Budget Office, 1990.

[5] Larson, Charles R. Admiral, USN. "Service Academies: Critical to our Future." *Proceedings*, October 1995, p. 34. Statistics represent only URL captains and admirals.

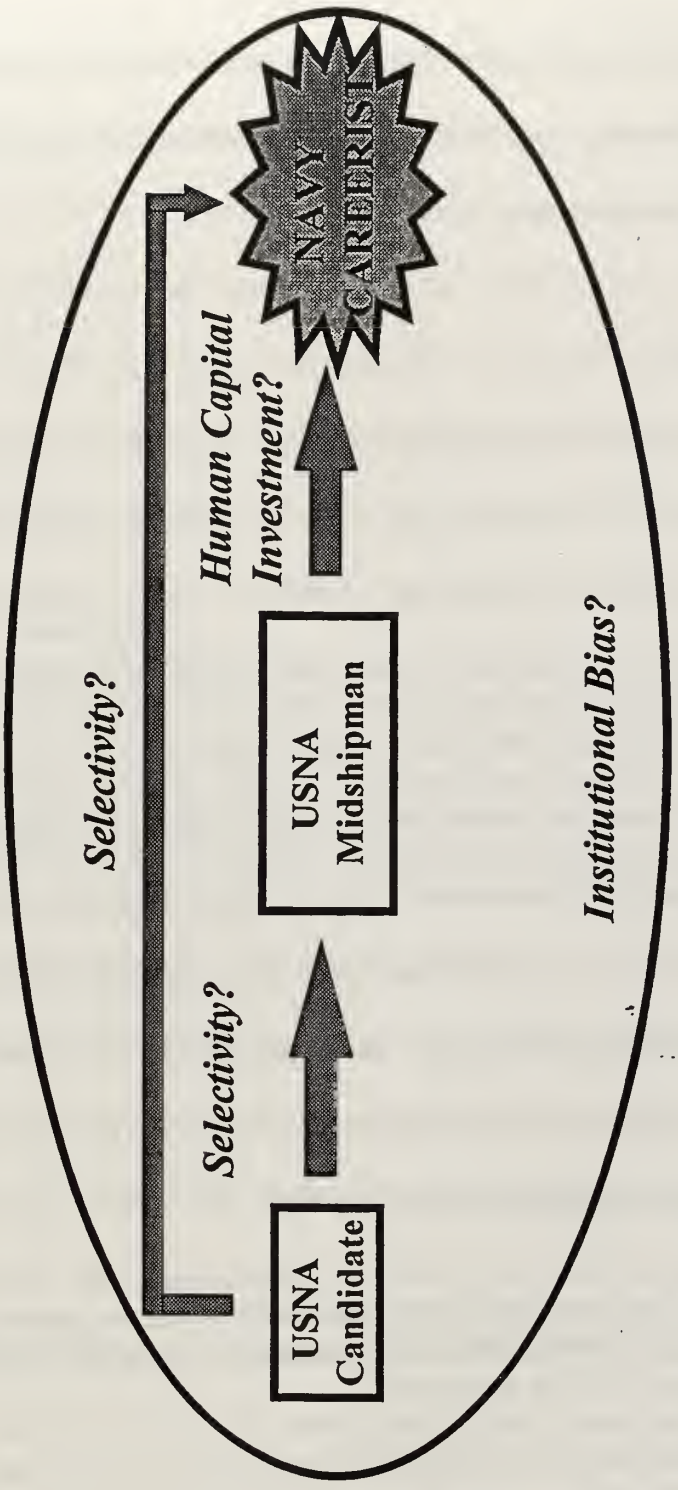

Figure 1. Introductory Model of Career Naval Officer Development

midshipmen, and institutional favoritism on the development of career naval officers from the USNA. Although the issues discussed in this thesis are relevant to all of the military branches, the research focuses on the Navy.

B. OBJECTIVES

In an era of decreasing defense budgets and limited resources for officer commissioning programs, it is essential that all services efficiently utilize existing resources to produce the most effective officer corps at minimum cost. In order to do so, the Navy must identify the relative contribution (or institutional impact) of alternative commissioning sources in terms of producing quality officers. Additionally, in an effort to select those with the highest potential for success, the Navy should identify predictors of individual success at the earliest possible stage of the development process. Herein lie the objectives of this thesis, which was undertaken to support the effort of Navy policy makers in making informed decisions concerning its future officer corps. The major objective of this thesis is to examine the fleet officer performance of the USNA's graduates. Specifically, this research attempts to answer two questions regarding their performance:

- *What is the relative strength of the aforementioned three hypotheses (Selectivity, human capital, and institutional favoritism) in explaining the fleet performance and retention of USNA graduates?*
- *Do significant predictors of officer fleet performance exist which could enhance the selection and performance criteria of USNA midshipmen, and thus improve the USNA's ability to attract and develop individuals who are more likely to achieve career success as a naval officer?*

The thesis investigates several databases in an effort to paint a complete statistical picture of naval officer development for a sub-set of USNA graduates serving in the Navy's URL communities. Utilization of alternative USNA selection, performance, and Navy officer fleet performance criteria are developed in Chapter V. Final composite measures of both USNA success and fleet performance and retention are adopted. Once these outcome measures are identified, the effects of the following categories of explanatory variables are analyzed and discussed:

- personal demographics;
- pre-USNA adolescent and secondary school indicators (selectivity);
- USNA development/performance indicators (human capital);
- post-commissioning Navy experience and post-commissioning demographics.

C. SCOPE, LIMITATIONS, AND ASSUMPTIONS

This thesis is not intended to provide a comparison of all officer commissioning sources. The thesis also does not attempt to conduct a cost-benefit analysis of each commissioning program. Rather, this study begins to investigate the development of naval officers using the USNA and its graduates as a case study. As such, the study offers insight and recommendations which are specific to the United States Naval Academy. However, some of the conclusions may also be generalized to other commissioning and training programs.

The USNA was selected for this study because of the availability of the data and the institution's interest in personnel research. The Dean of Admissions and Director of

Institutional Research have sponsored extensive personnel selection and performance research by NPRDC. Additionally, the author's experience and familiarity with the institution offered an excellent opportunity for detailed analysis.

The study focuses on the USNA Classes of 1980 through 1985. From this population, two samples are utilized. Those candidates who were selected for appointment as USNA midshipmen and accepted that appointment are included in the sample used to analyze midshipman performance. Data on candidates who were selected for appointment but did not accept the appointment were not available.

The second sample includes officers who graduated from the USNA and chose careers in the major Navy URL communities. This sample is used to analyze fleet performance, and includes surface warfare officers (SWO), submarine officers, navy pilots, and naval flight officers (NFO).[6] Officers commissioned from the USNA in the United States Marine Corps and either the Navy Restricted Line, Staff Corps, or smaller URL communities are omitted from the fleet performance data set. The major URL communities offer significant sample sizes, as well as standardized promotion rates. Additionally, the structured career paths of the major URL communities offer a consistent baseline for analyzing officer performance at various career points.

In analyzing fleet performance, there is a significant potential for selection bias. This arises because the data sets are restricted to individuals who first were admitted to the USNA

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[6] Officers from the smaller Navy URL communities (Special Warfare, Special Operations) represent such a small percentage of USNA graduates and URL officers that they were excluded from this data set.

through its highly competitive selection process, and secondly who completed the rigorous four-year USNA program and were commissioned as officers. This selection bias will be explained in greater detail in the statistical analysis.

While several alternative measures of officer performance are discussed, this study focuses on the "career potential" of an officer as a measure of both individual effectiveness (the selectivity hypothesis) and USNA effectiveness (the human capital hypothesis). Career potential (developed further in Chapter IV) incorporates both the individual's propensity to stay in the Navy as well as the Navy's organizational evaluation of his/her performance/potential as measured at officer promotion boards. A potential limitation of the study exists in analyzing a joint retention/promotion measure of career potential. It is possible that individual factors may have disparate effects on retention and promotion. The models utilized for this study will not be able to distinguish between such disparate effects.

D. ORGANIZATION OF THE STUDY

This study is organized into eight chapters and six appendices. Chapter II contains historical and background information on the USNA, as well as qualitative analyses of the USNA's selection and professional development processes. Chapter III reviews the pertinent literature that relate to the area of military officer selection and development. Chapter IV develops the theory utilized as a foundation in this study's empirical models, and explains the research methodologies employed. Chapter V describes the contents of the several data files that were merged for this study and used in the statistical analysis. Discussion of the pre-USNA and USNA background variables employed in the analysis is also presented in this

chapter. Chapter VI presents the empirical results of analysis of USNA performance, while Chapter VII presents the analysis of fleet performance. Chapter VIII summarizes conclusions from the research and offers both policy recommendations, and recommendations for further research.

II. UNITED STATES NAVAL ACADEMY

While service academies throughout modern history have provided their countries with the bulk of the career officer corps, many different educational philosophies exist. Western service academies evolved primarily from the classical Spartan and Athenian models. In his authoritative tome on the evolution of the American service academies, John Lovell contends that the concept of what a service academy should be incorporates both the Spartan ideals of the noble warrior and the Athenian ideals of culture and learning. (Lovell, 1979) While the USNA manages this delicate balance between Athens and Sparta, traditional American naval education also attempts to embody the words of the founder of the American Navy, John Paul Jones:

> It is by no means enough that an officer of the Navy should be a capable mariner. He must be that, of course, but also a great deal more. He should be as well a gentleman of liberal education, refined manners, punctilious courtesy, and the nicest sense of personal honor.[7]

Beyond a well-rounded education and technical skills, Janowitz hypothesized that the academies must prepare cadets and midshipmen for the particular style of life of military existence and indoctrinate them in the importance of heroic leadership. (Janowitz, 1960) None of these are easy tasks, but Lovell's, John Paul Jones' and Janowitz' theories for

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[7] Jones, John Paul, "Qualifications of the Naval Officer" from a composite letter of Jones as compiled by Augustus C. Buell, Reef Points: The Annual Handbook of the Brigade of Midshipmen (Annapolis: United States Naval Academy, 1987).

developing officers are still rather simple in the face of today's growing military complexity:

> The day is long past when every line officer could be expected to embody all the qualifications and specialties desired in a career... Rather, (service academies) undertake to produce line officers who collectively possess the wide range of knowledge and capabilities demanded of our modern military.[8]

This chapter examines closely the 152 year-old United States Naval Academy at Annapolis, focusing especially on the midshipman selection and professional development processes. Qualitative analysis of these processes will provide background for help the reader to understand this study's selectivity and human capital hypotheses of naval officer development. Due to their proven success in the past, little attention is paid to the quality or content of their selection processes or professional development programs:

> Here we have the managers, technical experts, and leaders of the world's conventional forces, professionals in violence, who hold the ultimate key to the success or failure of a nation's defense, and ... no one seems to be much concerned with how they're picked or how they're trained.[9]

A. HISTORY

The history of the United States Naval Academy extends almost as far as back as the

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[8] 1972-1973 U.S. Naval Academy Catalog, (Annapolis, MD: U.S. Naval Academy, 1972); quoted in Lovell, 7.

[9] Eitelberg, Mark J., Laurence, Janice H., and Brown Diane C., "Becoming Brass: Issues in the Testing, Recruiting, and Selection of American Military Officers." in Test Policy for Defense, (Boston: Kluwer Academic Publishers, 1992), p. 85. This reference offers an extensive review of the demographic background, testing and selection, training and education, and career patterns of American military officers.

U.S. itself, when President John Adams made his first recommendation to Congress for the founding of a naval school to serve as the foundation of a scientific and accomplished officers corps. However, opposition to the founding of an institution similar to the Military Academy at West Point was strong at this time. So, until the establishment of the USNA, midshipmen were educated by a school master, one of whom was embarked on every 75-gun frigate. Progress was made when, in 1839, a Naval School was established at the Philadelphia Naval Asylum along with other small naval schools in Boston, New York City, and Norfolk, VA. The course of instruction was to last one year and be mainly a means for the midshipmen to pass their Commissioning exam. (USNA Office of Public Affairs, 1996)

This concept came under scrutiny in 1842 after a midshipman-lead mutiny onboard the American Brig Somers. Following this incident, Secretary of the Navy George Bancroft decided to stop recruiting officers from miscellaneous ranks and teenage naval apprentice volunteers and instead to train an elite officer corps at a supervised academy. Through his efforts and without Congressional funding, the Naval School was established on October 10, 1845, with a class of fifty midshipmen and seven professors at a 10-acre Army post named Fort Severn in Annapolis, Maryland. The curriculum included mathematics and navigation, gunnery and steam, chemistry, English, natural philosophy, and French. Essentially, this Naval School was to serve as a trade school for future officers of the navy and maritime services. (USNA Office of Public Affairs, 1996)

In 1850 the school officially became the United States Naval Academy and adopted a new curriculum requiring midshipmen to study at Annapolis for four years and to train

aboard ships each summer. That format is the basis of a far more advanced and sophisticated curriculum at the USNA today. As the U.S. Navy grew over the years, the USNA expanded in campus size to 338 acres and brigade size to over 4000. Congress authorized the USNA to begin awarding bachelor of science degrees in 1933. (USNA Office of Public Affairs, 1996)

In the post-World War II period, the Holloway Board of Naval Education, as well as the DoD Service Academy Board, clarified the USNA's purpose--to serve as the bedrock of naval education and to produce the bulk of career naval line officers. Other commissioning sources, most notably the Reserve Officer Training Corps (ROTC), were permanently instituted to augment this cadre of officers, man the reserve naval force, and commission the speciality officers required of a larger career standing force. The ROTC was introduced due to capacity limitations at the service academies to complement the career officer corps with highly trained and educated young officers from the nation's leading colleges and universities. OCS would also eventually become institutionalized to serve to as an additional supply of college graduates on an as-needed basis. Meanwhile, the USNA would continue to "represent the ultimate in professional and personal standards, and that it and its graduates would be a tremendous binding force in the creation or a solidarity of loyalty and ideals of service in the Navy as a whole."[10]

The 1950 Service Academy Board built on the Holloway Plan to standardize the officer education system within the Department of Defense in the post Word War II

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[10] Board of Naval Education, (Washington, DC: Department of Navy, 1945), 7.

environment, reaffirming that the mission of the service academies is dictated by the qualities, abilities and attributes essential in a career officer. (Service Academy Board, 1950) In short, the so-called Stearns-Eisenhower board reported that the service academies should provide the following:

- Moral qualities required for leadership
- High degree of mental alertness
- Physical attributes of health, stamina and endurance
- Background of knowledge comparable to that possessed by graduates of leading universities
- Theoretical instruction supplemented with practical experience
- Motivation for a lifetime career as an officer of the armed forces

Though no longer able to serve as the sole breeding ground for career officers, the USNA and the other service academies were seen by the Service Academy Board as still unique among colleges in securing an early devotion to a military career. The report further stated that it would be "unlikely that the excellence achieved in the ROTC program could be maintained without (the service academies as) this bench mark of comparison."[11]

The 1960's was a period of academic revolution at the USNA during which time the needs of the new nuclear navy led to an increased emphasis on technical related subjects, as well a concurrent emphasis on the intellectual growth of military leaders. Admiral Hyman

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[11] Service Academy Board, (Washington, DC: Department of Defense, 1950), 21.

Rickover, the father of the nuclear navy, first brought this issue to a head with his cries for educational reform at the U.S. Naval Academy. Due greatly to his political influence and the need to man the Navy's new nuclear-powered ships and submarines, the Naval Academy adopted in the late 1960's a solid core curriculum of engineering, science, and professional courses, along with a broad majors program, a wide variety of elective courses, plus advanced study and research opportunities. The new curricula was to serve as a replacement for the fixed naval science curriculum taken by all midshipmen. The Air Force and Army similarly followed suit to varying degrees, but all greatly emphasizing engineering and sciences in their core curricula. (Lovell, 1979)

"The development of the Naval Academy has reflected the history of this country. As America has changed culturally and technologically so has the Naval Academy."[12] First, from a cultural perspective, the USNA's first black midshipman graduated in 1949, and in 1976, the USNA became a coeducational institution as Congress first authorized the admission of women to all service academies. Today minorities comprise almost 20 percent of entering plebes or freshmen, while women comprise about 16 percent, and all midshipmen pursue the same academic and professional training. And in just a few decades, the Navy moved from a fleet of sail and steam-powered ships to a high-tech fleet with nuclear-powered submarines and surface ships and supersonic aircraft. Technologically, the USNA has changed with the Navy, giving midshipmen the state-of-the-art academic and professional

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[12] U.S. Naval Academy 1995-96 Catalog, (Annapolis, MD: U.S. Naval Academy. 1995), 25.

training they need to be effective naval officers.

B. ORGANIZATION

The USNA's 600-member faculty is composed of an equal number of civilian scholars and experienced military officers. The civilian professors give the academic program continuity and a foundation of scholarship and teaching experience, and the officers bring fresh experiences and ideas from operational and staff assignments in the Navy and Marine Corps.[13] The joint military and civilian faculty and staff serve under the leadership of the Superintendent, an active-duty Navy flag officer.

1. Military Organization

The military staff of the Naval Academy serve in various academic and non-academic positions, but their primary role is in the Office of the Commandant and the Division of Professional Development. Additional military staff serve in support roles ranging from the Office of Admissions and Candidate Guidance to the Supply Department.

The Office of the Commandant is responsible for the activities of the 4000-plus member Brigade of Midshipmen. The Brigade is divided into two regiments, 6 battalions, and

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[13] USNA is unique among U.S. service academies in its 50-50 split between civilian and military faculty. USMA and USAFA faculty are estimated at 1/3 civilian and 2/3 military. This differential is due to the Navy's extensive operational sea duty requirements for its officer corps, thereby not allowing for top quality officers to dedicate substantial portions of their careers to teaching. The Army and Air Force place greater emphasis on the role of teaching in the careers of their officers, and their faculties include "permanent" military faculty members. (Lovell, 1979) A new program under review at the USNA would bring in military faculty with Ph.D.'s as permanent faculty.

thirty companies, all living, eating, and breathing within the massive midshipman dormitory, Bancroft Hall. Each Battalion and Company is supervised by an active duty military officer (O-5 Battalion Officer and O-3 or O-4 Company Officer), and each company is served by a senior enlisted non-commissioned officer (NCO) from the Navy or Marine Corps. Additionally, each company of approximately 120 midshipmen, comprised of male and female midshipmen from all four classes, is broken down into three platoons with three squads each. The daily activities of the Brigade are lead by midshipmen from the first class (seniors), who serve in roles ranging from Brigade Commander to Squad Leader.

The Division of Professional Development (PRODEV) is made up of the departments of Leadership, Law, and Ethics, Professional Programs, and Seamanship and Navigation. PRODEV is responsible for administering all formal professional military course and summer training programs. It is under the joint auspices of the Commandant of Midshipmen and the Academic Dean. Additionally, a new and independent Character Development Division, established by the Superintendent and Secretary of the Navy, is charged with providing oversight and coordination in the leadership and character development of midshipmen in an integrated four-year program.

2. Academic Organization

The Academic Dean oversees the 4 academic divisions and 20 departments, as well as an administrative academic structure. All academic matters are administered by the Academic Board comprising the Academy's military and academic leadership.

All midshipmen are required to take a certain core curriculum of engineering (25

semester hours), math and sciences (33 semester hours), social sciences and humanities (24 semester hours), professional military subjects (21 semester hours) and physical education. (USNA Office of the Academic Dean, 1985) While the USNA is fundamentally an engineering school, a broad majors program is offered to all midshipmen who study towards a Bachelor of Science Degree in one of three academic groups:

- Group I: Aerospace Engineering, Electrical Engineering, General Engineering, Marine Engineering, Mechanical Engineering, Naval Architecture, Ocean Engineering, and Systems Engineering
- Group II: Chemistry, Computer Science, General Science, Mathematics, Oceanography, and Physics
- Group III: Economics, English, History, and Political Science

Special academic opportunities, including honors programs and societies, independent research through the Trident Scholarship program, and graduate education at civilian schools in the Annapolis area prior to commissioning through the Voluntary Graduate Education Program (VGEP), are offered to a small number of outstanding students. Additionally, post-commissioning graduate education programs are offered to the top graduating midshipmen through the Burke and Olmstead Scholarship foundations.

C. VISION AND MISSION

> *To develop midshipmen morally, mentally and physically, and to imbue them with the highest ideals of duty, honor and loyalty in order to provide graduates who are dedicated to a career of Naval service and have potential for future development in mind and character to assume the highest responsibilities of command, citizenship, and government.*

This mission gives the USNA its unique clarity of purpose among undergraduate institutions. Yet despite its ties to tradition, the formal mission statement has changed slightly in the last thirty years. Prior to 1967, the mission focused on graduating junior officers ready to assume duties at sea. As academics became a higher priority for the service academies and as the services themselves grew more complex, the USNA gradually transformed itself from a naval or maritime trade school to a foundation for future naval leadership. This change is manifest in the 1967 mission revision calling for graduates "dedicated to a career in the Naval service" in contrast to the traditional call for "capable junior officers" ready to report to ships immediately upon graduation. (Lovell, 1979)

This transformation may be seen as a direct product of the increasing technological complexities found in initial fleet assignments. Specialized training after graduation became essential in the certain warfare communities, and gradually the Navy and Marine Corps introduced post-commissioning pipeline training of varying lengths for all warfare areas. Navy leaders began to view the USNA more as a foundation for career leadership rather than capable "officership."

In recent years, a new vision has surfaced among the USNA's officers and faculty

under the leadership of the present Superintendent, Admiral Charles R. Larson. The vision is for the USNA to continue to produce graduates to meet the new challenges of technology and changing world political conditions with courage, honor and integrity while upholding cherished traditions, leading to a new and better future. In accomplishing this and noting recent deficiencies in its "moral" development, the USNA has since 1994 placed an increased emphasis on character development with a particular focus on the associated attributes of honor, integrity, and mutual respect.

Despite the recent rash of service academy-bashing articles found in the popular media, the USNA is truly in a period of "character renaissance" under the leadership of Admiral Larson. External pressures stemming from various scandals in its recent history are primarily responsible for this. Larson, USNA Superintendent from 1983-1986, was selected to return in 1994 to steer the Academy back on a course of moral, mental, and physical development for midshipmen. Some of the more significant changes under Larson's leadership include the following:

a. Establishment of the Character Development Division to oversee the honor, ethics, and integrity development of midshipmen. It has helped to integrate the leadership training into a four-year continuum involving leaders from the military, academic, and athletic organizations. Training now focuses both on classical leadership and ethics philosophies, as a foundation for practical leadership as an upperclass midshipman and as an officer in the Navy or Marine Corps.

b. Revision of the "Service Selection" process. The old process driven strictly by the midshipmen Order of Merit has been redesignated "Service Assignment." The Order of Merit itself has been changed to increase emphasis on non-academic factors. And prior to service assignment, first class midshipmen are now interviewed by officers from each warfare community. These boards are used to identify non-quantitative and other motivational factors influencing a midshipman's desires. The new process which is still influenced greatly by the Order of Merit now allows for human intuition, and

is designed to best fit the needs of the Navy with the needs of the individual. (Interview, CAPT William Mason, USN, 1996)

c. Establishment of a fully-funded graduate education program with the Naval Postgraduate School (NPS) for prospective Company Officers (and potentially for Professional Development instructors.) This program, scheduled to begin in Spring 1997, will serve as a motivational tool to attract top quality officers and will enhance the leadership role and skills of the company officer in midshipman development. (Interview, CDR Patrick M. Walsh, USN, 1996)

d. Development of an effective "four year leadership laboratory" for midshipmen. This challenge involves a transition from the traditional harsh and intense leadership practices of Bancroft Hall into realistic fleet leadership practices. Company officers face a challenge, too, of involving themselves in every aspect of a midshipmen's life--establishing continuity between his or her life in Bancroft Hall, in the classrooms, and on the athletic fields--and not allowing a midshipmen to neglect his/her whole-person development either morally, mentally, or physically.

D. ADMISSIONS PROCESS AND STANDARDS

The USNA's Dean of Admissions has a task quite different from that of other undergraduate institution admissions directors in that the service academies are selecting for a profession in partnership with the Congress. The USNA, like the other service academies, employs a "Whole-Person" philosophy in its selection of and in the development of America's future officers. In 1958, Superintendent Melson first introduced the "Whole Man Concept" in the selection of midshipmen. (Sweetman, 1979)

This concept evolved under the direction of retired Rear Admiral and Dean of Admissions, Robert McNitt into an quantitative evaluative approach of all prospective midshipmen which takes into account all available candidate data, including extracurricular activities and evidence of leadership potential as well as academic achievement. (Interview,

Idell Neumann, 1996)

And in the last fifteen years, the role of the Candidate Guidance Office has broadened to go beyond guidance to a major recruiting and information effort, designed to help the Navy meet its diversity goals as well as increase the quality of incoming classes. A strong visitation program, field recruiting and information officers, and special outreach programs for exceptional high school youth are designed to simultaneously attract potential outstanding midshipmen to the Academy while "telling it like it is" about the rigors of life at USNA. This helps to ensure a quality class while minimizing early voluntary resignations. (Interview, Dean J.W. Renard, CAPT USN (Ret.), 1996)

1. Candidate Multiple

Since 1975, for each candidate, the admissions office has calculated a composite "Candidate Multiple" from the following criteria:

- SAT (or ACT) Math score;
- SAT (or ACT) Verbal score;
- high school class rank;
- high school teacher recommendations;
- composite participation score of high school athletic and non-athletic extra-curricular activities;
- technical-interest scale derived from the Strong-Campbell Interest Inventory (SCII);
- military career-interest scale derived from the SCII.

The Candidate Multiple was developed and has been refined through a joint effort by the USNA Dean of Admissions and the NPRDC, with revisions resulting from both policy decisions and more recently from empirical optimization of the predictors. (Interview, Neumann, 1996)

Annually, NPRDC validates and recalculates the weights of the multiple against specific USNA criteria--academic quality point rating, military quality point rating, choice of technical major, and total disenrollment.[14] The multiple is most heavily weighted on the academic criteria (approximately 2/3 of the total), though weights vary from year to year. The effective weight of the individual predictors (converted to scales of approximately 200-800 based on norming procedures) which make up the Candidate Multiple for the Class of 2001 are seen below in Table 2.1.

Table 2.1 USNA Candidate Multiple Effective Weights for Class of 2001.

Predictor	*Effective Weight*
SAT - V or ACT English	12
SAT- M or ACT Math	24
Rank in Secondary School Class	26
Recommendations of Secondary School Officials	14
Extracurricular Activities	8
Technical Interest	12
Military Career Interest	4

Source: USNA Admissions Office.

[14] For a more complete discussion of the Candidate Multiple see E.F Alf, I. Neumann, and J.D. Mattson, Revision of the United States Naval Academy Selection Composite, (San Diego: NPRDC, 1988.)

As is plainly evident, the Candidate Multiple for the Class of 2001 includes 62 percent directly from academic and scholastic aptitude scores, and places three times as much weight on potential interest in a technical major as in potential interest in a military career.

The USNA leadership has been aware of this inherent limitation in its selection process since its inception. Validation efforts have attempted to identify relationships between the whole-person Candidate Multiple and the actual fleet performance of USNA graduates but its recommendations have not been implemented.[15] The Candidate Multiple and therefore the role of the admissions process remains designed only to predict first year success as a midshipman and therefore to protect the Navy's investment against separation. Attempts to look beyond this scope, and eventually to shift the selection paradigm, have been deemed as infeasible in a selection process aimed at 17-18 year olds. (Interview, Dean Renard, 1996)

While the Candidate Multiple serves as the primary yardstick by which candidates are measured, the process does allow for human intuition. One most interesting dynamic in this whole-person selection process occurs at the USNA admissions board. Board members, according to recently retired Dean of Admissions Jack Renard, represent "a highly trained and most diverse group of Navy and Marine Corps officers, in addition to civilian faculty members." The Board reviews each candidate's record and may adjust a Candidate Multiple

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[15] A study by Neumann and Mattson, which will be further discussed in Chapter III, resulted in NPRDC's development of a proposed Officer Potential Composite (OPC), based on high school teacher's recommendations, extra-curricular activities, and the military career interest scale. (Neumann and Matson, 1989)

by as much as 20 percent. Adjustments, or so-called RAB's (Recommendations of the Admissions Board) are based on a candidate's personal statement, additional recommendations, unquantifiable aspects of a candidate's record, military background (personal or family), or special interest by the USNA in the candidates--minorities, women, and blue-chip athletes. (Interview, Dean Renard, 1996)

Theoretically, "reviewers may be able to see something important in a candidate's background, a positive or negative characteristic, otherwise omitted from the whole person score."[16] It should be noted though that Admissions Board members are cautioned against "over-intuition." CAPT Howard J. Halliday, USN, Chair of the 1996-97 Admissions Board reminds board members before each meeting to "stick to the facts, not what's not there." (USNA Admissions Board, 1996)

2. Nominations

Any discussion of the USNA selection process is incomplete without mentioning the primary driver of the process towards eventual appointment to the DoD service academies--the nomination. With rare exceptions (enlisted service members, sons/daughters of Medal of Honor winners) all candidates must first independently obtain a nomination from a member of Congress before he or she is considered for appointment by the admissions board. By law, Members of Congress have three options by which they can nominate candidates:

1. **Competitive Nomination Method** - nominate a slate of up to ten candidates for each vacancy for the USNA to evaluate and select qualified appointees based on the Candidate Multiple.

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[16] Eitelberg et al, 117.

2. **Principal Nomination Method** - designate one principal nominee with up to nine other alternates ranked in order of preference.

3. **Principal Nomination with Competitive Alternates Method** - designate one principal nominee with a competitive slate of up to nine alternates, and allow the USNA to select from among the alternates on a competitive basis for remaining appointments.

A principal nominee is assured appointment to the USNA provided that he/she meets the minimum Candidate Multiple criteria and passes physical and medical screening requirements. While the USNA is obligated to select one qualified (scholastically, medically, and physically) nominee for appointment from each congressional district vacancy, there is flexibility built into the system. The USNA is authorized to fill the entering class from a list of qualified competitive nominees and alternates, thereby maintaining quality and diversity in the selection process.

A review by the author of the applicable information provided to congressional staffs by the Congressional Research Service (CRS) and by the service academies themselves revealed no standard selection guidelines or direction for Members of Congress. The information includes backgrounds of the academies, similar to what might be found in academy catalogs, a time line of the academy application processes, an outline of the general criteria for which a candidate will be rated prior to an appointment being offered, and points of contact at the academies' admissions office. (Congressional Research Service, 1996)

The only specific guidance is offered in the area of Nomination Methods. The CRS guide clearly states that "it is strongly encouraged that Members nominate as many young men and women as possible for the different vacancies, as it enhances the quality of the

selection pool."[17] It further states that "the more competitive the method of selecting and evaluating nominees, the more likely the individual selected for appointment will be the best qualified."[18] It is evident from such boldfaced recommendations that the academies want the final say in whom they select for appointment to occur at the admissions board and not within the halls of Capitol Hill.

While the congressional nomination process does ensure a broad geographical representation of midshipmen from across the fifty states, the process may bias the selection process. Though it is unclear what percentage of appointments are offered via principal nominations, at a minimum, the nomination process does play a significant role in the initial screening of all applicants. Additionally, it is unknown how congressional staffs employ, if at all, the academies' recommended selection criteria.

Regardless, the make-up of today's congress poses an interesting question of the service academy whole-person selection process. "The 104th Congress includes 53 veterans among its 100 senators. Of the 435 members of the new House, 154 are veterans. By contrast, the 94th Congress of 1975-1976 had 73 veterans in the Senate and 306 in the House."[19] If such a widening rift between political leaders and military leaders does in fact exist in the wake of the All-Volunteer Force, then do congressional staffs, which are

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[17] Congressional Research Service, Congressional Guide for Admissions to the United States Service Academies, (Washington, DC: Congressional Research Service, 1996), 6.

[18] Ibid, p. 7.

[19] Lewthwaite, Gilbert A., "Military Growing Isolated from Society, Analysts Say," *Baltimore Sun*, 28 December 1994, 1.

presumably even more under-represented by veterans, have the requisite tools to select America's future military leaders? This preference dates back to the aforementioned 1950 Stearns-Eisenhower Report which concluded that "it seems preferable to leave the final selection to the service academies, which will select, on the basis of merit, the most outstanding individual among the nominees of each congressman."[20]

3. Degree of Selectivity

Defining what constitutes the "most outstanding" candidate may be at best elusive to both congressional staffs and the Admissions Board. While the efforts of the USNA Office of Admissions and NPRDC have made great strides in identifying the best candidates, there remains persistent questions of the criteria being used. Based on the above Candidate Multiple weights, the so-called "whole-person" concept appears to be skewed towards academic performance and scholastic/intellectual aptitude, perhaps as a direct result of the increasing role of academics at the USNA.

While attempts should continue towards identifying those candidates who are least likely to survive the moral, mental, and physical rigors of the USNA, a longer-term goal than merely success during the plebe year appears to be warranted. Actual fleet retention and officer promotion also should be used, in combination with USNA performance and graduation, as selection criteria if the Navy is to maximize the return on its training investment.

Indeed, the USNA is unique among undergraduate institutions in that it is not

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[20] Service Academy Board, 1950, 47.

selecting college students, but rather it is selecting future Navy and Marine Corps officers. (Interview, Dean Renard, 1996) As its mission has changed to effect a long-term career whole-person philosophy, so should its selection process. Evidence exists that there is nothing new about the idea of "selection for a profession, not an education" idea:

> In the final selection of men (and women) for the service academies, appropriate weight should be attached to the personal qualities that indicate potentiality for leadership. Otherwise, some men (and women) will be selected who, while intellectually adequate, will lack aptitude for leadership.[21]

Despite apparent shortcomings in the process, the USNA has remained "one of the few truly selective institutions in the country"[22] largely due to the proactive efforts of the Admissions Office, Candidate Guidance Office, and NPRDC. The Barron's Profile of American Colleges consistently ranks the USNA in its highest category of selective colleges--"Most Competitive"--along with the likes of Harvard and Stanford. This rating is based on the median SAT scores and grade point averages of incoming freshman classes, minimum SAT and class rank requirements, as well as percentage of applicants accepted. (Barron's, 1991)

Of the 9,962 applicants who initiated the application process for the Class of 2000, only 4,824 (or 48.4 percent) received nominations (congressional or other). Eventually, 1,527 offers of appointment were made, giving the class an extremely competitive selection

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[21] Service Academy Board, 1950, 26 (appendix).

[22] U.S. Naval Academy Admissions Office. Indoctrination brief given to the 1996-97 Admissions Board.

ratio of 13.3 percent or a nominee-to-appointment ratio of well over 3:1.[23]

Statistics from a profile of the Class of 2000 offer further evidence as to how the USNA has continued to attract the "best and brightest" in spite of military downsizing. For example, 25 percent of the class had Math SAT scores greater than 700, 77 percent of the class ranked in the top fifth of their high school class, 13 percent of the class were high school class presidents or vice presidents, and 85 percent earned a varsity letter in high school athletics. (USNA Admissions Office, 1996) Similar data showing the exceptional pre-USNA characteristics/experiences of the incoming classes of 1980 through 1985 will be found in this study.

Certainly, comparative statistics can be found at other colleges and universities in the "Most Competitive" category which offer NROTC programs, such as Notre Dame and Princeton. Where the overall selectivity differs of USNA graduates differs from ROTC and OCS officers is better seen at "Highly Competitive" ROTC schools such as Villanova and Boston University, "Very Competitive" ROTC schools such as Penn State and Missouri, "Competitive" ROTC schools including Norwich and Oklahoma, "Less Competitive" ROTC schools including Savannah State (GA) and Maine Maritime Academy, and even "Noncompetitive" schools like the University of Kansas and the University of Akron.

The statistics are truly impressive, but **the question remains as to whether the Candidate Multiple, or the individual predictors of the Candidate Multiple, ensure the Navy and Marine Corps the most career-oriented corps of 17-21 year old men and**

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[23] Ibid.

women. This thesis will explore this area by focusing on the long-term career potential of the USNA's graduates.

E. PROFESSIONAL DEVELOPMENT

The USNA further reinforces the "Whole-Person" philosophy in the moral, mental, and physical development of midshipmen during their four year program. A core curriculum of professional military courses and training is required for all midshipmen. Required courses in such areas as naval science, engineering, navigation, and weapons systems are designed to give midshipmen a working knowledge of modern naval operations and technology. Courses in leadership and military law attempt to prepare midshipmen for leadership responsibilities as an upperclass midshipman and as a naval officer. Ceremonial infantry drill engenders a knowledge of the customs and traditions of military ceremonies, as well as self-discipline and teamwork. Physical education and athletics teach midshipmen the value of physical fitness, the values of teamwork and competition, and how to stay fit for life. Eight weeks of annual summer training introduces midshipmen to the operational units of the Navy and Marine Corps, and exposes them to the numerous career opportunities available upon graduation. In addition, all midshipmen participate in monthly Integrity Development Seminars facilitated by teams of officers, faculty, and coaches for small groups. These seminars are designed to reinforce and augment the moral-ethical development of midshipmen over their four years at the USNA. (USNA Catalog, 1996) A more complete breakdown of the USNA's four-year professional development program is presented in Appendix A.

As stated earlier, the Class of 1985 core of professional development courses made up just 21 hours of the overall USNA core curriculum of 103 semester hours. The typical USNA graduate completes at least 140 semester hours, with the remaining hours, which vary by major, dedicated to majors courses. This in mind, we see that professional development courses are only a very small part of a midshipman's life at the USNA, 21.4 percent of the core and just 15.7 percent of the total. Here too, we see evidence of a skewed relative degree of emphasis between academics and military development, leading to a culture among midshipmen which subjugates their professional development in favor of academics. Beyond the plebe (freshman) year, almost all involuntary attrition from the Academy is academic related and a general feeling exists that "they can't kick me out as long as I've got that 2.0 (in academics)."

1. Measurement of Performance/Development

As in the selection process, the USNA attempts to quantify most areas of performance and midshipman development. The "Aggregate Multiple" serves as the nearest thing to a whole-person measurement instrument for midshipmen, and is composed of the following areas:

- Academic courses
- Professional Development courses
- Physical Education courses
- Military Performance grades
- Military Conduct grades

- Professional Competency Review (PCR) grades
- Summer Cruise performance grades

This Aggregate Multiple is compiled over a midshipman's four years at Annapolis in order to determine the graduation "Order of Merit." The Order of Merit is the class standing used in the former "Service Selection" process, by which first-class midshipmen select from among the available junior officer billets in the Navy and Marine Corps warfare communities.

Until recently, the Aggregate Multiple, and therefore the Order of Merit, has been a weighted average of the above areas, with approximately 70 percent assigned to academic performance and 30 percent to professional performance. (U.S. Naval Academy, USNAINST 1531, 1977-1996) Recent changes have seen an increase in the weighting assigned to non-academic measures such as military performance and physical education, and the elimination of the PCR and summer-cruise grades, as part of an effort to better measure a midshipman's leadership potential and his/her "Whole-Person" qualities. (Interview, Dr. Richard L. Davis, 1996) While the 70-30 academic-professional split is applicable for the classes of 1980-1985 used in this study, the Aggregate Multiple and thus Order of Merit has been revised as shown below in Table 2.2.

Table 2.2 USNA Aggregate Multiple Weights.

Performance Category	Percentage of Total
Academic & Professional Courses	64.48%
Physical Education	6.66%
Athletic Performance	3.38%
Military Performance *	16.68%
Military Conduct *	7.80%
Note: * Performance and Conduct include graduated coefficients that increase with seniority.	

Source: USNAINST 1531.51A.

These changes reflect a sincere attempt on the part of the USNA leadership to shift the **emphasis away from academic development towards whole-person development**. As Order of Merit and Service Assignment remains a primary motivation for most midshipmen, these changes are expected to result in a shift in their individual emphasis and priorities as well. Despite these changes though, **the question persists as to whether a 65-35 split goes far enough towards righting the potential conflict**.

2. Training Development and Validation

From time to time in its history, internal committees such as this the Holloway Board of Naval Education and special panels sponsored by the Board of Visitors have attempted to examine the effectiveness of professional military training. However, the closest to an Instructional Systems Design Model or a formal training needs assessment the author could find were John Paul Jones' famous words ("He must be that of course, but also a great deal more...") which are passed on from generation to generation. The USNA also lacks the tools

to validate the effectiveness of its military training. While progress is being made, the lack of formal internal structures such as a professional military training development staff show signs that such reforms may not endure.

Over the last ten years, two potentially effective validation tools were discontinued. The PCR was last given in 1993. Until then, the four level multiple-choice exam, given to midshipmen at the end of each academic year, measured their cumulative retention and knowledge of the wide range of professional military subjects. The PCR was disestablished for a number of reasons, most especially due to disagreement over its content, objectives, and testing methodology. And while the PCR could have served as a powerful internal validation measure against learning criteria (professional competency objectives), it was used more often to identify those midshipmen who required remedial training. (Interview, Dr. Paul Roush, 1996)

Another tool, the "GRAPES" (Graduate Performance & Evaluation Surveys) was comprised of two separate surveys sent to the commanding officers of graduates two years after graduation and to the graduates themselves three years after graduation. Their purpose was to solicit an evaluation of the Academy's role in developing the officer in a number of areas, whether or not he or she was adequately prepared, and what areas required increased emphasis. The GRAPES survey, a potentially invaluable external validation tool, could provide actual measures of Academy training performance/effectiveness against true behavioral and results criteria such as fleet performance, retention, and career development. Yet, the survey was discontinued due to budgetary constraints and a general consensus

among Academy leadership that the survey was not being used for this original purpose due to a lack of a training development staff and resources. (Interview, Dr. Roush, 1996)

As the USNA has restated its mission to reflect an emphasis on the "long haul" or military careers of their graduates vice the short-term junior officer performance, so should its measures of training effectiveness. As a result, if GRAPES or another post-commissioning validation tool is reinstituted, it too should focus on long-haul issues such as career propensity and leadership/command potential rather than on short-term effectiveness measures such as junior officer skills and performance. As the USNA and the other service academies are training the nation's future military leaders and serve as the foundation for America's military elite, both the academies and the services should be more concerned about the who, how, why, and what of professional development.

This thesis does not attempt to measure the overall effectiveness of USNA professional development. The research only attempts to measure the impact of professional development on the career potential of its graduates. This notwithstanding, it does appear from the above qualitative analysis that there remains considerable room for improvement in the relative emphasis on academics vice professional development, and in the area of training development. The nation's taxpayers are making a significant human capital investment in every USNA midshipman. It is thus incumbent upon the USNA to ensure the public earns the greatest return on its investment. This thesis will explore the effects of the USNA's extensive human capital investment the development of graduates into career naval officers.

III. LITERATURE REVIEW

The officer corps has rarely been examined in great detail, and as a result few studies have been concerned with how officers are selected and trained. (Eitelberg et al., 1992) Such limitations notwithstanding, this chapter explores the significant prior research from a range of disciplines on the development of military officers. Studies will be grouped by their applicability to the issues associated with selectivity, human capital investment, and institutional favoritism.

Although the objectives and methodology of some of the previous research differ from this thesis, the associated ideas provide a logical starting point for a study which attempts to explore the development of military officers. While this study is based primarily on labor economics and utilizes an econometrics methodology, a great deal can be learned from the other social sciences about the effect of selectivity and human capital investment, as well as institutional bias, on naval officer development.

A. SELECTIVITY

1. Prediction of Officer Potential

In a 1989 NPRDC study, Idell Neumann, Joyce Mattson, and Norman Abrahams, predicted the potential success of military officers using pre-commissioning selection variables. This study, Development and Evaluation of an Officer Potential Composite, was conducted in response to a request by the USNA to develop a measure of officer potential to be used in the selection of USNA candidates, thereby expanding the existing scope of the

system explored in Chapter II. While the Candidate Multiple had been proven to be an effective screening tool for evaluating candidates in terms of potential for early USNA success, its predictors had not been shown to be significantly related to officer fleet success. (Neumann et al., 1989)

The first step of their study was to develop a criterion for assessing officer performance. Navy Officer Fitness Reports (fitreps) were explored to determine the best criterion of officer potential for a sample of officers commissioned from the USNA between 1979 and 1982. While most Fitness Report performance areas were skewed greatly towards the top ratings due to grade inflation, the "Recommendation for Promotion" element showed sufficient variability to provide meaningful differentiation among officers. This element consisted of the reporting senior's recommendation of the individual officer for (1) early promotion, (2) regular promotion, or (3) no promotion. It is considered a critical factor in identifying superior officers, with the recommendation for early promotion appropriate only for those "'head and shoulders above' type performers who merit promotion ahead of their contemporaries."[24] Only 26 percent of the officers in their sample received recommendation for early promotion in every valid fitrep. Neumann et al utilized this "Recommendation for Promotion" element to develop an individual performance indicator, which was the percentage of an individual officer's fitness reports with a recommendation for early promotion divided by the total number of his/her valid fitness reports (REP). Valid fitness

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[24] Navy Military Personnel Command Instruction 1611.1, 12 May 1981, in Neumann, Mattson, and Abrahams, Development of an Officer Potential Composite, (San Diego: Navy Personnel Research and Development Center, 1989), 6.

reports include all "observed" fitness reports from the grade of Ensign (O-1) through Lieutenant (O-3).

Next, the study evaluated existing USNA operational and experimental selection scores for predicting the REP criterion. Utilizing first-order validity correlation as its methodology, the study found that although the composite Candidate Multiple measure was not related to officer performance, two of its individual predictor components, the Extracurricular Activities (ECA's) and Secondary School Teacher Recommendation scores, exhibited significant positive correlation relationships with the REP criterion. Additionally, two experimental predictors, empirically derived from individual extracurricular activities and individual SCII items related to officer performance, were significantly positively related to the REP score. An Officer Potential Composite (OPC) was then developed from three of these significant individual predictors (ECA's, school recommendations, and the officer performance SCII scale). The OPC was shown to significantly increase fleet performance while not adversely affecting performance as a midshipman.[25] Finally, the study showed that performance as a midshipman, as measured both by Military Quality Point Rating (MQPR) and Academic Quality Point Rating (AQPR), is significantly related to officer performance as measured by the REP score.

This study made significant advances in the area of officer development, not only by

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[25] The OPC was validated against USNA plebe year performance for a second sample, the USNA Classes of 1987 through 1990. A significant positive relationship was found between the OPC and both MQPR and attrition, though less positive than the operational USNA selectors. The data, though biased by the positive selection of USNA appointees only, suggest that there is "little risk that the OPC's use will adversely affect midshipman performance."

proposing a valid officer performance measure but also by revealing significant relationships with this measure of officer performance.[26] This is especially noteworthy and promising when one considers the significant time lapse between application to the USNA and the cumulative officer performance measure through the rank of Lieutenant (approximately 8 years). The researchers proposed further evaluation of the OPC with actual fleet officer promotion and retention, though no evidence of such research or of further consideration of integration of the OPC measure into the USNA selection system can be found.

Despite the significance of the NPRDC study to the field of military officer development, its relatively simple statistical methodology is a concern. By testing only first-order correlations of predictors with criteria such as REP, the study ignores the potential interaction of other related variables. For example, while REP may be positively related to a teacher recommendations, teacher recommendations itself may have a positive relationship with ECA's. The question of which predictor best statistically explains the success of a reference officer can only be determined through multivariate regression, which tests the significance of each explanatory variable in a model while holding all other variables in the model constant. This thesis will attempt to investigate the statistical relationships between the selection criteria and officer performance using such multivariate regression models.

A further limitation of the NPRDC study is the potential for selection bias assumed by examining only midshipmen who have been selected for appointment through the highly

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[26] The correlation coefficient (r) for the OPC with the REP criterion for the total officer sample is .21 ($p < .01$), varying slightly between warfare communities.

selective admissions process, and then by only examining officers who have completed the rigorous USNA program.[27] Finally, as the NPRDC researchers conclude, a more valuable analysis might examine the same selectors against actual life-cycle measures of the Navy's return on its education/training investment--retention and promotion.

2. Related Studies

a. Scholastic Aptitude

The Department of Defense (DOD) has long been interested in the aptitude of military personnel, but has only recently become interested in the aptitude of its officer corps. Lacking a valid DOD wide aptitude test for officers similar to the Armed Forces Qualifying Test (AFQT), they have turned to college admissions test scores as the best proxies available for officer aptitude. A database has been compiled at the Defense Manpower Data Center (DMDC) merging the DMDC Officer Cohort File of officers commissioned from 1975 through 1985 and the Educational Testing Service's (ETS) SAT data file, matching scores for approximately 56 percent of these newly commissioned officers. (Eitelberg et al., 1992)

Their study examined both promotion and retention for groups of officers in this sample, attempting to investigate the relationship between SAT and officer performance. The SAT means (combined Math and Verbal) were compared on the basis of promotion to O-2 and O-3. Across all the services, the SAT mean scores of all promoted officers are found

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[27] The potential for similar selection bias will also be found in this research, and it will be discussed in further detail in the following chapters.

to be higher than those of officers not promoted.[28] The retention analysis looked at the average number of months served through the grade of O-3 by officers above and below the 50th percentile for SAT scores. No significant differences were found within the services, though retention across all services for the "Above 50th Percentile" group significantly exceeded the retention for the "Below 50th Percentile" groups.

No conclusive evidence is offered by this study due to limitations in the data base, including the potential for geographic bias assumed by excluding officers who had not taken the SAT and had taken the American College Testing examination (ACT) most common to the Midwest. Despite this, it does point out some initial trends. The scoring differences seen in the analysis of promotion to the "quasi-automatic" grades of O-2 and O-3 may indicate a natural "weeding out" of lower aptitude officers, though further research is warranted. (Eitelberg et al., 1992)

b. Forecasting Transformational Leadership

Drs. Francis J. Yammarino and Bernard M. Bass of the Center for Leadership Studies (CLS) at the State University of New York (SUNY) Binghamton conducted extensive research on a limited sample of USNA graduates in the fleet in order to test a general model of transformational leadership and its relationship to both predictors and outcomes. Yammarino and Bass examined a representative sample of 186 USNA graduates serving in operational assignments in the surface warfare fleet. Data was collected from officer and midshipmen records, as well as from the sample officers themselves, 793

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[28] Significant at the .01 level for all services except the Marine Corps at the O-3 rank.

subordinates of the sample officers, and superior evaluations from fitness reports. (Yammarino and Bass, 1989)

The new model of leadership developed in previous research by Bass portrays a "transformational" leader as one who is able to articulate a realistic vision of the future that can be shared by and can stimulate subordinates, as opposed to the "transactional" leader who participates in an exchange of rewards for services with subordinates. His model empirically derived three essential factors of transformational leadership--charisma and inspirational ability, individualized consideration, and intellectual stimulation. Though transformational leadership is not a mandatory ingredient in effective career military officers, the literature suggests that it is likely to improve both individual and unit effectiveness. (Yammarino and Bass, 1988)

This model is applied to long-term forecasting of transformational leadership of USNA graduates in the fleet in Yammarino and Bass' second report. The study finds as predicted, that USNA academic selection criteria are valid predictors of academic and military success at the USNA. Yet, the USNA selectors are not found to be predictive of either this leadership measure or of future performance. Further, military performance is found to be an accurate and positive predictor of transformation leadership, as seen by subordinate-rated charismatic and inspirational leadership, and of future officer performance. And as hypothesized, the study further finds that transformational as compared to transactional leadership (rated by subordinates), was strongly related to the both the subordinate evaluation of effectiveness and to superior ratings in fitness reports (consequences or outcomes).

(Yammarino and Bass, 1988) While the study is limited to an extremely small sample of officers in only one warfare specialty, it offers credibility to the utilization of biodata and data on leadership traits to the selection of future military leaders.

c. "Human Research"

Dr. Karel Montor of the USNA Leadership, Ethics, and Law Department has conducted numerous "human research" analyses of the USNA class of 1980. Montor has examined whether predictive elements taken from a variety of data--including factors in blood, psychological and neurological profiles, as well as scholastic aptitude, and demographics-- impacted relative success as a USNA midshipmen and later as an officer in the Navy. (Montor, 1996)

Among the notable findings, Montor found that those who graduated from the USNA (compared to those who left either voluntarily or involuntarily) had as expected higher Candidate Multiple scores, and were more emotionally stable, conscientious, trusting, more in control of themselves, relaxed and less anxious, and less independent, with higher superego scores, and stronger boyfriend and girlfriend relationships.[29] Overall, Montor found no statistical difference between the Math and Verbal SAT scores of USNA graduates and non-graduates.

Additionally, Montor found that those non-female, black, and hispanic officers still on active duty after fifteen years of service had significantly higher Physical Education

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[29] All findings presented are significant at the 95% confidence level. Psychological characteristics are from the 16PF psychological factors test (16PF) and the Motivational Analysis Test (MAT).

and Military Performance grades while at the USNA than graduates no longer in the service. This group of "careerists" were also found to be more assertive (16PF) and had higher mating scores on the MAT. Again, no overall statistical differences in SAT scores are found between those who remain on active duty and those who leave the Navy. Despite this, black officers with lower Math and Verbal SAT scores are more likely to stay on active duty than fellow blacks. Motivation is postulated as the key to this interesting finding.

The above represent just a sample of Montor's on-going analysis of the USNA Class of 1980. His project is useful in that it demonstrates the wealth of factors, neurological, psychological, academic, and non-academic, that can be used to explain the differences in performance and career motivation between groups.

d. Personality Traits

Dr. Lawrence J. Stricker at the Educational Testing Service (ETS) constructed a biographical inventory of the USNA Class of 1991 during their plebe summer in an effort to identify the personality traits of midshipmen with significant potential for leadership. From the biographical inventory, Stricker develops five scales--Dominance, Emotional Stability, Need for Achievement, Self-Confidence, and Sociability. (Stricker, 1989)

These scales are analyzed against plebe year Military Performance grades and MQPR (hypothesized to reflect leadership potential), as well as peer ratings of leadership to test for correlation. Of the five scales, Sociability, Dominance, and Need for Achievement showed some signs of correlation validity with the USNA criteria, while Sociability was found to be correlated significantly with the peer leadership rating.

While this study indicates promise for utilization of personality traits as predictors of leadership potential, the methodology makes the practical value of the study questionable. As plebes spend their entire first year at the USNA being indoctrinated to the Navy and the Academy, an examination of plebe leadership lacks true value. The emphasis of "followership" during the Plebe year makes the Military Performance grades as well as the peer ratings of leadership poor proxies for leadership potential. While "followership" is certainly an essential ingredient of leadership, and is essential to early junior officer performance. A follow-up study of the personality scales as predictors of first-class midshipman leadership ratings and officer success is recommended.

B. HUMAN CAPITAL INVESTMENT

1. Undergraduate Education

Professor William Bowman tested the so-called "Rickover hypothesis" that "the best naval officers are those with a solid technical college background" in his 1990 study, "*Do Engineers Make Better Naval Officers?*" The objective of his study was to model the statistical relationship between an individual's undergraduate academic background as a measure of his/her investment (quality and quantity) in human capital, and later performance as a fleet officer. Academic background was measured by grade point average (quality) and major (quantity, assuming that engineers receive more Navy-applicable human capital than their peers). Fleet performance was defined in the Bowman study as retention six months beyond minimum service requirement and "superior" ratings in "command desirability" and

"overall summary" by commanding officers in junior officer fitness reports at the end of their fourth year of service. Bowman was unable to establish a relationship between the academic world of the USNA and junior officer performance in the surface and submarine warfare communities, with controls for personal characteristics and Navy-specific factors related to ship type and job description.[30] (Bowman, 1990)

Bowman studied USNA graduates from the classes of 1976 through 1980, merging personal demographic and Navy experience data from the DMDC 1986 Navy Officer Master/Loss Files with the associated NPRDC longitudinal profile of the individual officer fitness report entries. Empirical models of junior officer experience and human capital were developed, utilizing nonlinear maximum likelihood estimation techniques. Overall, Bowman found that performance and retention of officers is related more to personal characteristics than to academic background. Academic measures, such as academic major and grade point average (GPA) within grouped courses (engineering, math/sciences, humanities) are found to be less significantly and less positively related to officer performance and retention than achieving warfare specialty qualification as a junior officer, race, or marital status. He concludes that junior officer performance is more a measure of managerial skills than leadership or technical skills, as management/economics majors are more likely to receive high ratings, and that retention is more related to personal characteristics than to acquired human capital.

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[30] Academic factors are found to be significantly related to the service selection, as measured by the probability of a midshipman selecting the Nuclear Navy (surface ships or submarines.)

Despite its acclaim as a landmark study in this area, a weakness of Bowman's study in testing the Rickover hypothesis is the homogeneity of the sample. The 1560 USNA graduates from the years 1976-1980, serving in surface warfare and submarine communities of the Navy, do not display great variance in their level of technical education. As discussed above, all USNA graduates undergo a solid core curriculum of engineering, science, and mathematics courses. In fact, due to the heavy emphasis of this technical core, all graduates, even those who major in the humanities and social sciences, receive a Bachelor of Science degree. This fact demonstrates that all USNA graduates are to a degree "engineers"--prepared to adequately understand (if not to design) the technical systems for which they will be responsible as junior officers. Thus, the differences between technical and non-technical majors are minor, and not as great as they would be for ROTC or OCS officers who were graduates of civilian universities.

Several studies of the relationship between job performance and undergraduate education have been performed in the civilian sector as well. A significant study conducted by AT&T is highlighted in LCOL Mitchell M. Zais', USA, 1990 article "West Point: Sword Making or Swordsmanship." (Zais, 1990) The study examined the leadership, management performance, and career advancement of first-level general managers over a 30-year period. College major was found to be the most important factor in accounting for differences in performance--more important than academic performance, college prestige, or extra-curricular activities. AT&T's study concluded that humanities and social science majors were "clearly superior in all measures of overall performance and progress." The study also found

that engineering majors lacked important leadership and managerial skills. Logically opposite to the flaw in Bowman's study, the application of the AT&T study to the military environment is limited to the extent that all officers are selected primarily utilizing "whole-person" criteria (Eitelberg et al., 1992) and theoretically would not be lacking in such people or managerial skills.

Another study of note, including both public and private sector career success was conducted by the Standard & Poor's Corporation with a related analysis by Professor Michael Useem of Boston University. The study, highlighted by Dr. William P. Snyder in an Air University Review article, included a survey of some 50,000 top executives in 38,000 public offices and private American companies, and found that the highest-ranking executives typically came from general education, usually liberal arts, backgrounds. Executives who had specialty majors in business administration were less successful. (Snyder, 1985) In contrast to the Bowman study, the Standard & Poor study reflected too heterogeneous a sample to be applied to the current context of the military in that it explored a very diverse array of firms.

Works such as these and by retired Navy Admiral William Stockdale (Stockdale, 1984) continue to argue against the increased technical emphasis seen both in service academy curricula and ROTC programs and for a return to increased emphasis on the liberal arts. A clear need to strike a balance between technical specialization and general education has been demonstrated by such studies. Few dispute that the Navy does need some highly-trained technically-oriented officers. The question of whether or not the Navy needs a "Navy

of modern engineers" will again be addressed in this study, though it is not the major focus.

2. Graduate Education

Donald J. Cymrot at the Center for Naval Analyses (CNA) assessed the benefit to the Navy of fully-funded graduate education for its officers. In doing so, Cymrot developed both theoretical and empirical models of graduate education, its marginal costs, and its marginal benefits using officer promotion as a measure of officer productivity. (Cymrot, 1986)

It can be hypothesized that officers with graduate education are relatively more productive than their peers. Cymrot utilized non-linear LOGIT models of the probability of promotion to the next higher rank within a given period to empirically measure this increased productivity for a sample of officers. Cross-sectional data was obtained in March 1985 from the Navy's Officer Master File, after eliminating officers who had left the service. Cymrot concluded that the graduate education has a significantly positive effect on the probability of officer promotion up to and through the rank of Captain.

A notable weakness to this study is Cymrot's use of cross-sectional data, as opposed to a data set that tracked officer cohorts. This would have accounted for those officers either voluntarily or involuntarily separated from the Navy, and would have accounted for differences in promotion rates by fiscal year. Additionally, selection bias, which Cymrot attempts to compensate for by including previous experience and job performance in his models, undoubtedly still affects the empirical results. The Navy selects officers for graduate education by some of the very same criteria it promotes its officer corps, including promotablity, thereby ensuring a select group of officers with graduate education. Such

selection bias has been found in numerous follow-on graduate education studies, despite various techniques attempting to compensate for it.

Bowman further advanced the study of human capital and military job performance with Dr. Stephen L. Mehay in a 1996 study, *Human Capital and Job Performance in a Hierarchical Organization: Evidence from Military Personnel.* Mehay and Bowman examine the relationship between graduate education and on the job performance, as measured by actual promotion to Lieutenant Commander (LCDR), for Navy officers reviewed by promotion boards between 1985 and 1990. (Mehay and Bowman, 1996)

Following the earlier work of David A. Wise (Wise, 1975), Mehay and Bowman specify their promotion model by assuming that relative performance depends on accumulated human capital. Wise had studied the promotion of managerial and professional workers, partitioning their accumulated human capital into two stocks--cognitive and affective skills. Cognitive skills are those learned skills and accumulated knowledge attributed to intellectual aptitude and academic performance, while affective skills include those non-academic personal factors such as perseverance, cooperation, self-discipline, leadership, and initiative. Mehay and Bowman include in their model such cognitive skills as college grade point average, type of undergraduate degree, and graduate degree, and attribute affective skills to accession source to the Navy's officer corps. Commissioning programs such as the USNA are assumed to imbue an individual with a greater level of affective skills than ROTC or OCS officers, owing to the USNA's four years of Navy specific education, training, and socialization .

Wise had previously found in two studies of individual firms that both the salary and probability of promotion were increased by a graduate degree. Wise also found that affective skills contributed to a worker's productivity. Controlling for undergraduate education, personal demographics, warfare specialty, and fitness report scores, Bowman and Mehay build on the work of Wise to specify non-linear PROBIT models of promotion within the Navy to LCDR.

Their results, consistent with the findings of Wise, show that graduate education significantly increases the probability of promotion, indicating a positive effect of additional human capital in the military's internal labor market. They also show that the promotion probability for USNA graduates is significantly higher than for those who entered via other routes, supporting the impact of affective skills on performance and the notion that USNA graduates possess a greater stock of such firm-specific affective skills.

Positive selection bias is seen again in this study as the more "promotable" officers (based on fleet performance) are also more likely to be selected for graduate education. Further, such officers selected for advanced education tend to have stronger academic backgrounds. Bowman and Mehay address the selection issue in two ways. First, they simply include undergraduate education background variables as controls in a single-stage model. Second, they add an endogenous selection process to the model and estimate the promotion equation using an instrument for attendance at a fully-funded graduate school, which is uncorrelated with the error term in the promotion model. Treating graduate education as endogenous reduces the overall direct effect of graduate education. However, a graduate

degree nonetheless remains a positive and significant factor in the promotion of Navy officers.

C. INSTITUTIONAL FAVORITISM

1. Historical Context

Janowitz offers an outstanding historical portrait of the dominance played by the service academies in producing the elite members of America's military hierarchy. The statistics offered are revealing. Military leadership, defined by Janowitz as general or flag officers, consisted almost exclusively of West Point or Annapolis products through 1935 (81 percent in the Army and 98 percent in the Navy). World War II brought about a sharp change in these numbers for the expansive Army and new Air Force, while the Navy was able to continue its practice of reliance on USNA training for its future leaders. While the percentage of Army leadership from West Point had dropped to 58.4 percent, Annapolis graduates still constituted 96.6 percent of the Navy's leadership. (Janowitz, 1960)

Despite these statistics, Janowitz offers no specific evidence of bias within the services which might account for the high percentage of service academy graduates in the top officer ranks. Instead, Janowitz explained his findings on the basis of multiple factors--social origins, career motivation, aptitude, education, self-image, and career development among them--none of which alone explain this phenomenon. Janowitz suggests that all of these factors are increased for service academy graduates. Janowitz's greatest insight is found in several sociological arguments and predictions for the development of a new professional soldier

model.[31]

Over time, even the Navy's leadership ranks have changed. As of September 1987, academy graduates represented 29.9 percent of the Army's general officer ranks and 47.3 percent of the Navy's flag ranks. Yet as one examines the trend up through the military leadership hierarchy, the percentage of academy graduates rises at each successive rank. (Eitelberg et al., 1992) This trend continues despite the lower percentage of service academy graduates among newly commissioned officers.

Though the perception of an academy ring as being a prerequisite for military leadership has waned, a 1984 Gallup Poll of U.S. military general and flag officers revealed that 88 percent of the officers felt that "being a service academy graduate" helped one succeed in the military. (Eitelberg et al., 1992) Unfortunately the poll goes no further towards asking the officers why being a service academy graduate helped one succeed in the military or whether an institutional bias existed.

While no overt signs of institutional favoritism are found in these works, the historical context of service academy dominance in the officer corps lends some sociological credibility to the idea that such a bias favoring service academy graduates may exist. This is seen in the

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[31] For greater insight on the impact of societal changes and changing recruitment trends for military officers, see Fitzgerald, John A., "Changing Patterns of Officer Recruitment at the U.S. Naval Academy," *Armed Forces and Society*, 8 No. 1, Fall 1981; Cochran, Charles L., "Midshipman and Cadet Profiles and National Norms: A Profile," *Naval War College Review*, XXIV No. 9, May 1972, and "A Comparison of Naval Academy Plebes and College Freshmen Over Twenty Years" (USNA Internal Report, 1996); or Snyder, William P., "Officer Recruitment for the All-Volunteer Force: Trends and Prospects," *Armed Forces and Society*, 10 No. 3, Spring 1984.

persistent over-representation of service academy graduates at the highest military ranks.

2. DOD Studies

While DoD and the services have commissioned numerous studies to assess potential institutional discrimination by race, ethnicity, and gender, no prior research could be found in the area of favoritism or bias by officer commissioning source. The studies reviewed focused on equal opportunity (EO) climate, training, sexual discrimination and harassment, promotions, discipline, and recruitment.[32]

A recent Government Accounting Office (GAO) study advocates a standard criteria and methodology for Military Equal Opportunity Assessments (MEOAs) across the services. The criteria or expected outcomes include accessions, assignments, and promotions. While discrimination/bias can exist in all these processes, this study will focus on identifying potential favoritism in promotions. The advocated "odds-ratio" methodology involves calculating the odds of a particular group member being selected for an outcome. An odds ratio is obtained by dividing the odds for one group member by the odds of another group member for the same given outcome. Equal odds therefore will result in an odds ratio of 1. This methodology enables researchers to determine if the difference in odds is statistically significant, or if it is due to random chance. (GAO, 1996) While this methodology is recommended for use across DoD, it does not allow researchers to include possible related factors such as aptitude or performance ratings, and therefore assess whether subgroups such

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[32] See General Accounting Office, *Equal Opportunity: DOD Studies on Discrimination in the Military*, (Washington, DC: General Accounting Office, 1995) for an outstanding survey of the relevant military EO studies and advances in the last twenty years.

as minorities and non-minorities were essentially equal.

Finally, a thorough review by the author of the Navy's Promotion Board Precepts (or guidelines) for fiscal years 1985-1996 O-4 through O-6 showed no trace of overt bias which might give preferential treatment to USNA graduates. As USNA graduates have historically been over represented in the Navy's higher ranks, this study will look for a more subtle bias by examining the relationship between the outcomes of promotion boards and representation, by commissioning source, of the senior officers charged with making the promotion decisions.

D. COMPOSITE STUDIES OF OFFICER DEVELOPMENT

While Janowitz's Professional Soldier, and more recently, the chapter "Becoming Brass" by Eitelberg, Laurence and Brown in Test Policy for Defense, offer comprehensive surveys of the complex issues involved with military officer development, they do not focus on specific officer cohorts and few practical lessons can be applied. *Successful Officer Careers: Analysis of Augmentation, Promotion, and Voluntary Continuation* by James North, Dan Goldhaber, Kletus Lawler, and Jeremy Suess at CNA, offers a comprehensive review of Marine Corps officer development. In an effort to analyze the extent and causes of racial-ethnic differences in career success, the researchers propose five possible factors that may explain the differences--occupational preferences or assignment, ability, motivation, discrimination, and performance at The Basic School (TBS). (North et al., 1995)

The researchers created a Headquarters Master File (HMF) of longitudinal data from personnel records beginning with FY 1987, combined with files from TBS, augmentation

selection and promotion boards, and loss records. Numerous non-linear multivariate LOGIT models were run to determine the significant factors for predicting success. The following summarize the results of the models:

- Race/Ethnicity: "Other minorities" have significantly lower augmentation selection probabilities than white officers. Both blacks and "other minorities" exhibit lower probabilities of promotion to captain (O-3), and blacks have a lower probability of promotion to major. No statistical differences are found in promotion to lieutenant colonel (O-5) or retention.

- TBS Performance: TBS leadership class rank is positively and significantly related to all future officer "success"measures--promotion, augmentation, and retention.

- Mental/Academic Aptitude: As measured by General Classifications Test (GCT) scores, mental aptitude does not appear to be significantly related to any of the "success" measures. Only at promotion to major is the GCT important, where it is negatively associated with probability of promotion. Undergraduate academic major is not significantly related to any of the success measures.

- Occupation: Officers in certain occupations have higher probabilities of promotion than others. Support officers are associated with a significantly lower probability of promotion than combat officers. And as compared to ground combat officers, pilots and judge advocates tend to be more successful (as one would expect based on their high level of human capital.)

The most important findings in this study are the significance of TBS leadership rank and the insignificance of mental aptitude as predictors of officer success. The authors recommend an increased emphasis on assessing leadership potential and decreased emphasis on mental aptitude in both screening and selecting future Marine Corps officers. The study suggests that capable minority officer candidates with excellent leadership potential are being screened from service because of the Marine Corps' stringent mental aptitude requirements.

E. MEASURES OF EFFECTIVENESS

The issue of military officer effectiveness has been approached from many angles. It is likely that no single measure of effectiveness will ever be universally agreed upon as most valid. In this chapter alone, we see a number of substitute (or proxy) measures of effectiveness, including fitness report scores, recommendation for promotion, promotion to various ranks, retention, time to promotion, professional qualifications, augmentation, and subordinate ratings.

LT Joseph F. Nolan, USN, addresses this concern in a master's thesis, which analyzes various measures of effectiveness (MOE)--retention between the LT and LCDR selection boards, promotion to LCDR, and early professional qualifications--and the relationship of background factors to them for a sample of surface warfare officers. Nolan utilized data from the Navy Officer Master File, Officer Loss File, and the NPRDC Traintrack System File from 1981 through 1990 to develop LOGIT models of the MOE. The thesis reveals that a significant amount of the variability in the MOE reflect differences in human capital acquired in pre-commissioning education or Navy training/experience. (Nolan, 1993)

Nolan's analysis of the surface warfare community was effective at identifying some relationships between background factors and various measures of performance. Additionally, the thesis provides further evidence that there is little agreement on the best measure of officer performance. For example, the measure of early professional qualification is often criticized as being biased by individual opportunities and command philosophies (varying underway days between ships, command philosophy of qualification, and division

officer responsibilities.) Indeed, similar criticisms can be applied to every other MOE.

F. SUMMARY

This study incorporates several ideas from the literature in an effort to portray a comprehensive picture of naval officer development. While methodology, data sets, and objectives obviously differ between studies, each of the reviewed research studies make significant contributions to the interdisciplinary area of military officer development. As Nolan and others make clear, a true statistical measure officer effectiveness may never be found. The applicability of such measures depend on either the objectives of the organization, or the analysis itself. For example, while this study will focus on the effects of various background factors on the probability of a U.S. Navy officer becoming a "careerist", we might never be able to determine if those career officers are in fact the most effective leaders of the American military.

IV. MODEL DEVELOPMENT

A. THEORETICAL MODEL DEVELOPMENT

1. Career Development

As the purpose of this study is to empirically examine the potential impact of three unique processes--**selection**, **professional development**, and **favoritism**--on the career development of naval officers, a final composite metric of career potential must first be developed. The literature review reveals that no single measure of officer productivity, performance, or effectiveness has been identified. Prior studies have focused on one, two, or three of the most readily available proxies such as evaluations by superiors (fitness reports), retention (beyond minimum service requirement (MSR)), professional qualifications, and promotion. Earnings, commonly used in civilian economic studies, have generally been ignored due to the hierarchical pay structure of the military and the strong linear correlation between years of service and earnings.

Simply stated, if national security is the output of a military officer's service, measuring individual effectiveness at meeting this goal is a difficult task. Whereas the productivity or performance of most civilian professionals can be measured in financial terms, how does one place a value of the service of a military officer in defense of a nation? Based on these given limitations and using the very words of the USNA's mission--"a career of Naval service"--the assumption is made here that an Academy graduate's true measure of personal effectiveness is a career of service to the U.S. Navy. And as the focus of the

USNA's output has traditionally been and continues to be line officers, the study incorporates the "supremacy of the line" concept explored by Peter Karsten by restricting the effectiveness measure to the unrestricted line. In the U.S. Navy, line officers have historically been perceived as superior to and more valuable than staff or restricted line officers. (Karsten, 1972) This "supremacy of the line" concept continues today from a cost perspective when one considers the enormous training investment made by the Navy in its nuclear officers and jet pilots. (Bowman, 1995) Thus, the USNA's true contribution to the Navy is the development of career naval officers in the unrestricted line.

As seen in Figure 1 above, graduation from the USNA and a career-orientation are the two essential ingredients in the development of a career naval officer. This study will utilize these two essential "career" ingredients--**GRADUATION** and **CAREER POTENTIAL**--as the key criteria and thus as the dependent variables in the regression models.

a. USNA Graduation

While some argument can be made as to the potential for midshipmen making an individual contribution to the Navy through USNA performance, it is assumed in this study that a midshipman's only value to the Navy is realized upon graduation and commissioning as a junior officer. And while career-orientation is a complex dynamic involving many external factors, graduation from the USNA is quite simple. A midshipman must have the moral, mental, and physical discipline, talent, and motivation in order to complete the rigorous four-year USNA program. A historical graduation rate of 75 percent of the incoming plebe

class indicates that this essential first ingredient is neither easily attained nor impossible. The selectivity model of USNA success, developed below, will estimate the impact of the Academy's selection criteria on the probability of a midshipman graduating from the USNA.[33]

b. Career Potential

The study of career potential evaluates naval officers who graduated from the USNA in terms of both retention and promotion. Retention is evaluated between the Lieutenant (O-3) and Lieutenant Commander (O-4) promotion boards for all USNA officers who successfully make it through the O-3 screen (approximately 98 percent of all commissioned officers). Promotion is measured by the O-4 URL promotion board, at roughly 10 years of service, among those officers who have remained in the Navy to this point. Mehay and Bowman pointed out that O-4 promotion is "the first significant chokepoint of an officer's career," and thus the decisions of this board significantly shape the face of the Navy's career officer corps.

The models include both the officer's first significant career decision of whether he or she wants to remain a part of the organization beyond his/her MSR, and the Navy's first significant decision regarding the officer's relative value and whether it wants the officer to remain a part of the Navy. These decisions are utilized to estimate the probability of an officer becoming a "careerist." It is assumed that to be a career naval officer, the two

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[33] Midshipmen who will be commissioned as non-URL officers, as Marine Corps officers, or into another service are virtually indistinguishable from Navy URL officers during their USNA development. For this reason, the graduation model will examine all midshipmen. The characteristics of these groups are presented in Appendix B.

decisions must be answered affirmatively.

First, the USNA graduate must make the decision to stay after his/her MSR (5 years for non-aviators, up to 7 years for aviators) expires and extend his/her career in a URL community to the O-4 promotion board (approximately ten years.) It is assumed that this individual decision will be based on the strength of the officer's commitment to the organization. Second, the Navy must make an assessment of the officer's value to the organization at the promotion board and decide whether or not to promote the individual. If both decisions are made affirmatively, the officer is assumed to be a "careerist."

An estimation of the probability of becoming a career officer will be made by treating the two post-commissioning decisions jointly. The probability of becoming a "careerist" (of these two events to occur sequentially) is simply the probability of retention multiplied by the probability of promotion. (Newbold, 1995) For example, if an officer's probability of retention is 0.4, but his probability of promotion is 0.8, then the probability of that officer becoming a "careerist" is 0.32. Alternatively, the "yield rate" for 100 newly commissioned URL officers with these retention and promotion probabilities is 32 "careerists."

The conditional relationship of retention and promotion is a limitation of this study in that behavioral characteristics such as propensity to stay in the Navy or likelihood of promotion are indistinguishable from one another. Two notional officers, one with a probability of retention of 0.9 but with a promotion probability of only 0.4, and the other with a 0.6 probability of both retention and promotion, each have the same probability of

developing into careerists (0.36).

2. Selectivity

Selection is defined as the process of choosing for employment a subset of applicants available for hire, and is predicated on the premise that some applicants are better suited for a job than others. Its purpose therefore is to identify the superior candidates. (Muchinsky, 1993)

The economic foundation of this study's selectivity hypothesis for military officer development from the service academies includes two aspects of selection behavior. First, the USNA, and Navy as a future employer, apply a screening process through the nomination and admissions processes. In these processes, the nomination itself as well as the Candidate Multiple are essentially "screens" or "filters," easily measured characteristics which take the place of more Navy-relevant measures (e.g. technical/managerial skills, commitment, and self-discipline) in order to identify "better" candidates. The Navy relies greatly upon these screens in making its USNA appointment decisions.[34]

A self-selection process occurs when a USNA candidate first makes the decision to compete for an appointment, and then after having received an appointment, chooses to accept the appointment and the rigors and discipline involved with four years of full-time military education and the post-commissioning obligation to the Navy. It is hypothesized that USNA midshipmen, who have chosen to enter the officer corps via a service academy rather

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[34] This theory is based upon the work of Kenneth Arrow and John Riley, among others. (Cited in Bowman, 1990).

than through a NROTC scholarship or OCS program, have at a very early age a higher level of motivation and taste for military service and thus are more likely to be career-minded.

Valuable insight into the strength of this selectivity theory can also be seen from an Industrial and Organizational (I/O) Psychology approach. As seen above, multiple factors, or predictors, are utilized to identify such "better" candidates. One critical factor in assessing the utility of a predictor is the "selection ratio."[35] Simply, the selection ratio (*SR*) is the number of job openings (*n*) divided by the number of job applicants (*N*):

$$SR = n/N$$

Regardless of the other factors, the smaller the selection ratio for a firm, the greater the predictor's utility or value. Obviously, with an *SR* equal to 1, even the best designed predictor has little value. The firm will have to accept every applicant walking through its doors. In this case, the USNA maintains an extremely low selection ratio. As an example, for the class of 2000, whether one uses total number of applicants (9,962) or number of applicants with a qualified nomination (4,824) as its *N*, the *SR* varies from a low of 15.3 percent to no greater than 31.6 percent. Indeed, the self-selection can also be seen in the case of the Class of 2000 as only 1,212 of those 1,527 accepted for appointment actually entered the USNA. It is assumed that a majority of those with the requisite aptitude de-selected themselves on the basis of their taste for the military, lowering the Class of 2000's *SR* to 12.2 percent. While the reliability and validity of the USNA's predictors and criteria can be

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[35] Muchinsky, Paul M., Psychology Applied to Work, 4th Edition, (Pacific Grove, CA: Brooks/Cole Publishing, 1993), 154. Other factors contributing to predictor utility are criterion reliability, criterion relevance, predictor reliability, and predictor validity.

debated at length, it is clear that such a low selection ratio goes far towards ensuring a quality input of students to the USNA by increasing the relative value of the predictors.

Based on the screens utilized and the quality ensured by such a low selection ratio, it is hypothesized that the USNA's selection process and degree of selectivity play an important and positive role in naval officer development. This study will incorporate both the overall USNA Candidate Multiple and then the individual predictors in models in order to empirically measure the impact of selectivity first on the probability of graduation from the USNA (Chapter VI) and secondly on the probability of an officer developing into a careerist (Chapter VII).

3. Human Capital

Human capital is a labor economics term intended to conceptualize workers as embodying a set of knowledge and skills that can be rented out to employers. This set of knowledge and skills, which comes from education and training, including the training that experience yields, generates a certain stock of productive capital. (Ehrenberg and Smith, 1994) Human capital theory focuses on the expected returns of human capital investments both by individuals and by society.[36] These returns include a higher level of earnings, greater job satisfaction over one's lifetime, and a greater appreciation of nonmarket activities and interests.

The basic assumption of this theory applied to the firm or to society at-large is that

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[36] See for example Becker, Gary, Human Capital, (New York: National Bureau of Economic Research, 1975).

increased human capital will increase worker productivity. In this case, the Navy as an employer (and society) is assumed to make investments in the general formal education, and also the Navy-specific and general training of midshipmen. Investments will be made as long as the present value of expected returns exceeds the present value of total costs.[37]

Measurement of these productivity returns is especially difficult in the context of military personnel, because no tangible final product--evaluated at market prices--is produced. As explained earlier, the unquantifiable national defense output remains the objective of the Navy and of each individual officer. As a proxy for USNA effectiveness and officer productivity, this study assumes that the return to the Navy is in the form of a career-oriented officer. This measure incorporates both individual retention behavior and the firm's promotion behavior in this case of the military's "up or out" personnel system.

Human capital will be explored on three levels. First, overall USNA performance, the Aggregate Multiple, is assumed to be the accumulated quantity of an individual's human capital. Secondly, as in Bowman's 1990 study, the human capital model in this study accounts for both the quality and quantity of human capital investments at the USNA through the use of proxies. Quality of human capital is accounted for in the model through academic grades in both academic and professional/military areas. Midshipmen with higher levels of academic performance in these areas are assumed to have acquired a greater quality of

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[37] Alternative labor economics theories view higher education as providing society with a *screening* device which sorts individuals by ability, or a *signaling* device which determines for society those individuals who are innately productive. In both cases, it is assumed that higher education does not augment the work place productivity of individuals. See Ehrenberg and Smith, 1994, for a complete explanation of education as such a screening or signaling device.

specialized or general human capital. Quantity is accounted for by academic major, as well as leadership or athletic experience. Relative to the average midshipman, it is assumed that an engineering major or a midshipman leader in the Brigade of Midshipmen will have acquired a greater quantity of human capital. Based on human capital theory, it is hypothesized that the quantity and quality of human capital invested by the Navy in the individual, and by the individual himself/herself, positively impacts the probability of an officer becoming a "careerist."

Finally, following Wise (and Mehay and Bowman) this study will partition accumulated human capital into stocks of cognitive and affective skills. Cognitive skills will include the performance of midshipmen in both academic and USNA professional courses, while affective skills will be measured utilizing both overall military performance as well as more qualitative measurements such as leadership or athletic achievement. Based on the previous works of Wise, and Mehay and Bowman, it is expected that increases in both cognitive and affective skills will positively impact the career potential of USNA graduates.

4. Institutional Favoritism

Labor market discrimination or bias is said to exist when a subgroup of workers with identical productive characteristics are subject to a pattern of unequal treatment. Such unequal treatment could include both wage discrimination and occupational segregation. The former refers to unequal wages for equal services, while the latter involves restricting subgroups of a population from certain occupations or levels of responsibility. (Ehrenberg and Smith, 1994)

The focus here is the Navy's internal labor market. Classic discrimination studies focus on unequal treatment based on gender, race, ethnicity, lifestyle, and even age, but not undergraduate institution. However, a similar bias might be found in large civilian firms. A favorable bias my be seen, for example, applied to Ivy league graduates, while a negative bias may be applied to graduates of historically-black colleges and universities (HBCU's). Due to the unique nature of the subject matter and limitations in the officer sample (USNA graduates only), this study incorporates an ad-hoc model of officer representation at the LCDR promotion board in order to investigate possible favoritism through occupation segregation.

USNA graduates are traditionally over-represented at the higher ranks, which are charged with the selection of junior officers for promotion, leading to the possibility that there is some bias favoring USNA graduates at lower promotion boards. Therefore it will be necessary to determine just how over-represented this subgroup has been on promotion boards. A test of the institutional favoritism hypothesis would be to investigate the relationship between the percentage of senior USNA graduates serving on a given promotion board and the differential in the promotion outcomes for USNA graduates versus the overall promotion rate for all Navy officers in the same years groups.

It is acknowledged that this study's definition of institutional favoritism is limited to only the most obvious and blatant form of potential bias. Research and data restrictions make the inclusion of more subtle areas of potential favoritism, such as the initial assignment process or fitness report grades, beyond the scope of this study. However, these are

interesting areas for further research.

B. EMPIRICAL MODEL DEVELOPMENT

Two groups of explanatory variables are utilized for the graduation models: demographic variables and USNA admissions variables, which represent the selectivity of the school. The latter group of explanatory variables are observed upon entering the USNA and are expected to positively impact the individual's probability of graduation. Thus, the model to examine the impact of USNA selectivity on graduation is specified as:

Selectivity: ***GRADUATION = f(Demographic Variables + USNA Admissions Variables)***

This model will be further specified and evaluated in Chapter VI.

In the career potential models, two groups of explanatory variables--USNA admissions (selectivity) and USNA performance (human capital)--are utilized to estimate their impact on career development. Additionally, demographic and post-commissioning warfare community and marital status dummy variables are included. The selectivity and human capital explanatory variables are all observable at the Lieutenant (O-3) selection board and are expected to positively influence an officer's decision whether or not to "stay Navy" as well as the Navy's promotion decision.

Additional post-commissioning variables such as graduate education, fitness reports, and qualifications which are observable at the O-4 promotion board are not included because they may not be observable at the time of the retention decision. Furthermore, as the Navy's

promotion decision is theoretically based almost exclusively on performance and qualifications, their inclusion would introduce a simultaneity bias into the careerist models. Including a variable such as an individual's REP score as an independent variable would result in essentially modeling the same promotability characteristics simultaneously on opposite sides of the regression equation. Thus, two different groups of models are estimated to investigate the two causal factors of selectivity and human capital.

Selectivity: ***CAREER POTENTIAL = f(Demographic Variables + USNA Admissions Variables + Post-Commissioning Control Variables)***

Human Capital: ***CAREER POTENTIAL = f(Demographic Variables + USNA Performance Variables + Post-Commissioning Control Variables)***

These models will be further described and analyzed in Chapter VII.

As USNA graduate representation on a promotion board by fiscal year will be directly related to the relative promotion opportunities by fiscal year, institutional favoritism can not be accurately estimated in a multivariate regression model. It will be evaluated along with the above models in Chapter VII by cross-tabulation methodology, in order to determine any relationship between senior USNA officer over-representation and higher promotion opportunities for USNA junior officers.

1. Regression Methodology

This study utilizes both linear and non-linear regression techniques to estimate the "Graduation" and "Career Potential") multivariate models. USNA graduation and career development are utilized as dependent variables. Each model is estimated for a pooled sample

of USNA midshipmen and graduates from the classes of 1980 through 1985.

Binary logistic models (LOGIT), using maximum likelihood techniques, offered the best estimation of the graduation and "careerist" decisions, because both decisions are both coded as binary (1=Yes, 0= No) variables. This offers a reasonable estimation, with large sample sizes, of the probability of each outcome. Actually, the non-linear LOGIT probability characteristic can be thought of as the "log-odds" that the decision in question will be made. Quality of LOGIT model fit is assessed using the -2 LOG L criterion, while predictive accuracy is estimated from the concordance ratio of paired responses. Based on the -2 LOG L criterion, the model's overall null hypothesis of zero explanatory power will be either rejected or not rejected. (Studenmund, 1992)

While no inference regarding model fit or quality of fit can be gained from the linear probability models (using ordinary least squares techniques) due to the unboundedness of the probability characteristic and inherent heteroskedasticity of the error term, these models were utilized to assess multicollinearity, serial correlation, heteroskedasticity, and to obtain comparative estimates of the significance and weighting of the independent variable's effects. (Studenmund, 1992)

Next, the more efficient LOGIT estimates are evaluated at the mean level of all independent variables, and recalculated given marginal changes in these explanatory variables. Essentially, this transformation generates the marginal probability effect for the reference (or notional) midshipman/officer of a change in an independent variable. (Gujarati, 1995)

2. Hypothesis Testing

Based on the theories of USNA graduate selectivity and human capital investment explored above, null hypotheses for the explanatory variables are developed and will be tested through the regression analyses. First, in terms of graduation, we expect the degree of selectivity, based on the USNA's selection criteria, of an individual to have a positive impact on his/her likelihood of graduation. Therefore, the null ($\mathbf{H_0}$) and alternative ($\mathbf{H_A}$) hypotheses are as follows:

$$\mathbf{H_0}: \beta_{\text{SELECTIVITY}} \leq 0$$
$$\mathbf{H_A}: \beta_{\text{SELECTIVITY}} > 0$$

The null hypothesis states the range of values (less than or equal to 0) of the selectivity variables' regression coefficients that are expected to occur if the selectivity theory is *not* correct. The selectivity hypothesis is thus stated by the alternative hypothesis. Through evaluation of the regression models in Chapter VI, the null hypothesis will be rejected if the selectivity variables' β coefficients are positive. Otherwise, the null hypothesis will not be able to be rejected, and we will not be able to prove or disprove the validity of the selectivity theory. Since the alternative hypothesis has values on only one side of the null (or "zero") hypothesis, "one-tailed" tests are used to determine the significance of the coefficients. (Studenmund, 1992)

Similar hypothesis testing is used for the career potential models in Chapter VII. Based on the underlying theories developed above, we expect both the selectivity and the accumulated human capital of an individual to have positive impacts on career development.

Therefore, the null and alternative hypotheses are stated as follows:

$$H_0: \beta_{SELECTIVITY} \leq 0$$
$$H_A: \beta_{SELECTIVITY} > 0$$

$$H_0: \beta_{HUMAN\ CAPITAL} \leq 0$$
$$H_A: \beta_{HUMAN\ CAPITAL} > 0$$

The null hypotheses again state the range of values of the selectivity and human capital variables' regression coefficients that are expected to occur if the theories are *not* correct. Regression models of career potential are estimated in order to test the hypotheses. The null hypotheses of selectivity and human capital will be rejected if the explanatory variables' β coefficients are positive. "One-tailed" tests are used to determine the significance of the coefficients due to the positive specification of the alternative hypothesis.

3. Data Restrictions

The graduation models explored in Chapter VI are not intended to be representative of all interested USNA applicants, or even all those offered letters of appointment. They examine only the probability of graduation for those who are actually inducted as midshipmen. It is further noted that by modeling graduation as a binary (1=yes or 0=no) dependent variable, the study does not distinguish between involuntary and voluntary resignations. This restriction will be explored in greater detail in Chapter VI.

Similarly restrictive, the models of career potential in Chapter VII are only of those officers who graduated from the USNA, and were commissioned as officers in the unrestricted line. Though the sample may or not be representative of the entire Navy officer corps, the results are applicable to only this sub-set of officers as will be demonstrated in

Chapter VII.

The Navy's URL officer community, as previously discussed, can be grouped into four core designators--Surface Warfare, Submarine Warfare, Pilot, and Naval Flight Officer. URL officers are reviewed at the same career point by common promotion boards which ideally hold no distinction between warfare communities. Due to this and other similarities between the career paths of officers within these communities, this study analyzes the decision processes of the individual and the Navy pooled together in one sample. Despite the similarities, common control variables in the career potential models are used in order to account for the warfare community self-selection process and a possible resulting bias which will be explored later. Previous research by Heckman and Maddala indicated that such a bias may exist if better or more qualified and/or motivated individuals are more likely to select one community over another. For example, aggregating officers in the Navy's more selective aviation and nuclear-power programs with officers in the less selective surface warfare community may in fact introduce this bias. (Bowman, 1990) Additionally, separate models are estimated by warfare community in order to identify significant discrepancies from the common URL models. These results are presented in Appendices D through G.

V. THE DATA

The data used in this research to estimate the various models were derived from a number of sources. Several data sets were merged to create a very robust database for the USNA Classes of 1980 through 1985. The merged database tracks individuals from the tenth grade (approximately age 15-16) through their tenth year of commissioned service (ages 31-36). In addition to its applicability to this study, the newly created database will be available in the future for related research in the development of naval officers.

USNA applicant data come from the USNA Applicant files maintained by the Navy Personnel Research and Development Center (NPRDC). USNA midshipman performance information is derived from a number of sources, including the USNA Midshipman Performance files also maintained by NPRDC, a matrix database of the USNA Registrar Office, as well as historical paper records from the Office of the Commandant of Midshipmen, the Naval Academy Athletic Association (NAAA), and the USNA Trident Scholarship Office.

Post-commissioning data were derived from the Officer Promotion History Data Files created by Bowman and Mehay and maintained at the Naval Postgraduate School (NPS). This database provides demographic and background information on all officers in the major URL communities reviewed by the O-3 and O-4 promotion boards from 1976 through 1995, as well as actual promotion board results. The Bowman-Mehay file itself incorporates a file with individual officer Fitness Report data, the Navy's Officer Master File, and the Officer Loss File for all U.S. Navy officers in year groups 1976 through 1986 from commissioning

as Ensigns (O-1) through their O-4 promotion boards. Finally, the author obtained historical Navy promotion board records in order to compile board membership lists. Table 5.1 below summarizes the complete sources of data.

Table 5.1 Components of the USNA Database.

Source	Data	Type
NPRDC	USNA Admissions Files	Computer-Based
NPRDC	USNA Midshipmen Performance Files	Computer-Based
USNA Registrar	USNA Academic Performance	Computer-Based
USNA Institutional Research	Brigade Leadership Records	Hard-Copy
USNA Institutional Research	Varsity Letter winner Records	Hard-Copy
USNA Trident Scholar Office	Trident Scholar Records	Hard-Copy
NPS	Officer Promotion & History Files	Computer-Based
NPS	Officer Master File	Computer-Based
NPS	Fitness Report Files	Computer-Based
Navy Office of the Judge Advocate General (OJAG)	Promotion Board Precepts	Hard-Copy

After matching by Social Security Numbers (SSN) and Midshipman ID's, the above files were merged to create one quasi-longitudinal database. The following sections highlight the different groups of variables from the merged data set that were used in the multivariate analysis.

A. DEMOGRAPHIC VARIABLES

This first group of variables included in the models reflect personal demographics. The *MIN1* racial/ethnic group variable is binary signifying an individual's status as either a minority or not, as identified on the USNA's applicant file. Earlier studies have attempted to further divide this minority classification into black, Hispanic, and others. While this would be advantageous, this sample population's relatively insignificant number of Hispanics and others precludes this. The three groups are therefore combined into a single minority status. *FEMALE1* is a binary variable[38] derived from the applicant file identifying female midshipmen/officers. Females were first admitted to the USNA with the class of 1980, the first class of our sample. It should be noted that no females are included in the submarine officer category due to warfare community restrictions on females entering this community.

IDAYAGE is a continuous variable of an officer's age upon entrance to the USNA, Indoctrination Day (first week in July of plebe year.) This variable is utilized in the "GRADUATION" models. In the "CAREER POTENTIAL" models, *GRADAGE*, a continuous variable derived from the applicant file's date of birth data to determine age at commissioning (approximately 30May of his/her year of graduation), is used. It should be noted that the USNA does not allow anyone over the age of 22 to enter the USNA, so the age variables show little variance. Prior studies have shown that officers commissioned at an older age are more likely to exhibit the stable behavior characteristics of career military

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[38] Generally binary variables are equal to 1 when something is true (e.g. minority) and otherwise equal to 0 (e.g. non-minority.)

officers both at the retention decision and promotion decision points. (Mehay and Bowman, 1996)

Two additional binary demographic variable, *MILFAM* and *PRIORNOM*, are derived from the applicant file nomination source data. *MILFAM* = 1 if an individual was raised in a military family (officer or enlisted). All midshipmen who had obtained a nomination to the USNA from one of the following non-congressional sources were assumed to be from a military family: Medal of Honor (sons/daughters of Medal of Honor recipients), Presidential (sons/daughters of career military or retired military parents), or Deceased Veterans/ (sons/daughters of deceased veterans). While this variable may not capture all those midshipmen who were raised in a military family, it is the most reasonable proxy given the data available. *PRIORNOM* = 1 if a midshipman served on active duty as an enlisted man/woman in the Navy or Marine Corps prior to entering the USNA. Midshipmen with a Regular Navy and Marine nomination code are included in this category.[39] It is hypothesized that individuals from military families and/or with prior military service will have accumulated a lifetime of military socialization and are more likely to be oriented towards military careers of their own.

The binary coded *CIVPREP* = 1 for those midshipmen who attended a civilian preparatory school or had a minimum of one full semester at a four-year college prior to entering the USNA. *MILPREP* = 1 for those individuals who attended a military prep school

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[39] It should be noted that prior-enlisted reservists are not included in this category due to possible confusion with Naval Academy Prep School (NAPS) students (see below), all of whom must enlist as reservists in order to attend NAPS.

(sponsored by the USNA), prior to entering the Academy. This category includes graduates of the following institutions: Naval Academy Preparatory School (NAPS), Naval Academy Foundation-funded preparatory schools[40], or the Navy's Broadened Opportunity for Officer Selection and Training (BOOST) program. Post-secondary education theoretically increases an individual's human capital prior to entering the USNA and is hypothesized to increase his/her likelihood of graduation. Furthermore, midshipmen in the *MILPREP* category are likely to have acquired a greater degree of Navy-specific training or at least military socialization.

The binary variable *RECRUIT* denotes all athletes who are actively recruited by varsity NAAA coaches in accordance with the rules of the National Collegiate Athletic Association (NCAA). NAAA recruits highly talented student-athletes in support of the USNA's intercollegiate athletic program. The final demographic variables identify an individual's USNA class as binary control variables. For example, *CLASS80* = 1 for the USNA Class of 1980, *CLASS81* = 1 for the Class of 1981, and so on.

Table 5.2 Demographic Variables.

Variable	Description of Code
MIN1	1 = Minority, 0 = White or Unknown
FEMALE1	1 = Female, 0 = Male or Unknown
IDAYAGE	Age upon entering USNA (01July of 4th Class Year)

[40] The Naval Academy Foundation annually funds a select number of prospective midshipmen, with demonstrated outstanding leadership potential but requiring additional academic preparation, at civilian prep schools.

GRADAGE	Age upon graduation from USNA (30May of 1st Class Year)
MILFAM	1 = Career Military Family, 0 = Non-Military Family or Unknown
PRIORNOM	1 = Prior Active Enlisted Navy/Marine Corps, 0 = Other
MILPREP	1 = Military sponsored Prep School, 0 = Other
CIVPREP	1 = Civilian Prep School, 0 = Other
RECRUIT	1 = Student-Athlete recruited by NAAA, 0 = Other
CLASS8X	1 = USNA Class of 198X, 0 = Other

B. USNA ADMISSIONS VARIABLES

The USNA Database at NPRDC includes applicant data on each midshipman's prior experience and education. The data sets included represent the scores of the Candidate Multiple and its predictors, and personal background data submitted by USNA candidates during the application process. The applicant variables used in this research are derived both directly and indirectly from the USNA database documentation provided by NPRDC. (Wahrenbrock and Neumann, 1989)

The Candidate Multiple is represented by the variable *CM*. This empirically derived score, which was described in great detail in Chapter II, represents the weights assigned to individual predictors and includes the additional factor (RAB) based on the recommendation from the USNA Admissions Board (up to +/-9000 points). Individuals whose Candidate Multiple scores were in the highest 10 percent are coded in this research with the binary variable *TOP10CM*, and the highest 5 percent are included in the binary variable *TOP5CM*. Proxies for these dummies will be used in the marginal effects analysis to exhibit quantum

leaps from the mean Candidate Multiple. Due to the whole-person nature of the Candidate Multiple, it is expected to be significantly related to both USNA and fleet performance though research by Neumann and Abrahams (1989) found no relation between the *CM* and early junior officer performance. It should be noted here that the Candidate Multiple weighting was not identical for the Classes of 1980 through 1985. As a result of the very slight variations, the *CM* variable is not consistent through this sample.

Scholastic Aptitude Test (SAT) scores are represented by the variables *SATMHI* (Math) and *SATVHI* (Verbal). These scores (on a scale of 200-800) indicate an individual's highest Math and Verbal SAT scores, or its empirically-derived equivalent from the American College Test (ACT). SAT scores represent the quantitative and verbal aptitude of an individual as measured by the two college admissions testing programs.[41] Individuals who scored in the top 20 percent of both the Math and Verbal SAT are coded with the binary variable *TOPHSAT*. SAT scores are expected to be significantly positive in the "GRADUATION" analysis, yet due to the time lapse between time of the test and the "careerist" decision points they are expected to be insignificant in the analysis of "CAREER POTENTIAL."

Rank in secondary school class (*RC*) is translated to a standardized score based on an individual's rank and the size of his/her graduating class. *RC* ranges from 200 to 800.

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[41] Research at NPRDC indicates that for multiple test-takers, their individual average SAT score is a more accurate predictor of USNA performance than their individual highest score. (Cowen and Abrahams, 1982) Since that time, individual average scores have been utilized in the Candidate Multiple. Unfortunately, due to inconsistencies in data recording, average SAT scores were not available for the entire sample of midshipmen in this study.

Individuals scoring 800 are high school valedictorians and are coded with the binary variable *NUMBER1* for use in cross-tabulation, and by proxy in the marginal effects analysis. Similar to SAT scores, high school class rank is expected to be significant related to USNA success, but is not expected to be related to fleet performance.

RECS is a recommendation score based on high school officials' estimates of an applicant's potential for success as a naval officer. English and Math teachers evaluate students on communication skills, interpersonal relations, personal conduct, and leadership potential. An objective standardized score, on a scale of 0 to 1000, is derived from the evaluations. As early as 1950 in the Service Academy Board report, recommendations of teachers, employers, and coaches have been seen as the most effective method of measuring the moral character of candidates. "Carefully constructed rating scales filled out by individuals who have had opportunity to see and compare the candidate with his age mates provide more valid judgements with regard to this intangible quality."[42] It is therefore assumed that midshipmen with higher *RECS* scores will be more likely to succeed at the USNA and in the fleet.

Extracurricular activities (ECA's) are evaluated on the basis of an individual's Candidate Activities Record (CAR), which covers participation from 10th to 12th grade in both athletic and non-athletic extracurricular activities during high school. A rationally-derived scoring system is used to compute a candidate's composite score in this area. For example, earning a varsity letter during one's senior year might contribute 50 points to this

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[42] DOD Service Academy Board, 1950, 22.

score, while being the team captain in the same sport might earn an additional 75 points. This score which ranges from 300 to 800 is represented by the variable *COMPECA*. Based on the research by Neumann and Abrahams (1989), ECA's are expected to significantly increase one's performance at the USNA and in the fleet.

Disenrollment interest (*DIS*), military career interest (*CIS*) and technical interest (*TIS*) are scales consisting of items from the aforementioned Strong-Campbell Interest Inventory (SCII), a commercially-available career guidance instrument. Items from this inventory are keyed to differentiate between USNA graduates and non-graduates, between high- and low-tenure naval officers, and between those with high and low interest in a technically-oriented curriculum to create the disenrollment, career, and technical interest scales, respectively.[43] They are then transformed linearly to scores with a mean of 500. *DIS* and *CIS* are expected to be related to USNA and fleet success, respectively, due to their inherent relationships.

Table 5.3 below presents a summary of the variables derived from the Candidate Multiple score and its individual predictors. Continuous score variables will be utilized in the multivariate regression analysis, while the truncated binary variables will be utilized in cross-tabulations and the marginal effects analysis.

Table 5.3 USNA Admissions Predictors.

Variable	Description
CM	Candidate Multiple
TOP10CM	Top 10 Percent of Candidate Multiple = 1; 0 = Other

[43] For further information see Neumann and Abrahams, 1974 and 1982.

Variable	Description
SATMHI	High Math SAT (200-800)
SATVHI	High Verbal SAT (200-800)
TOPHSAT	Top 20 Percent of Math and Verbal SAT = 1; 0 = Other
RC	Rank in Secondary School Class (200-800)
NUMBER1	High School Valedictorian = 1; 0 = Other
RECS	HS Teacher Recommendations (0-1000)
COMPECA	Composite ECA Score (300-800)
DIS	Disenrollment Interest Scale
CIS	Career Interest Scale
TIS	Technical Interest Scale

Several binary variables, representing outstanding pre-USNA experiences, were derived from the CAR. Such experiences may be found to be useful as predictors of military career potential. For example, an individual who has served in a significant leadership position prior to college may in fact be a "natural leader." Or an individual who has attained the highest rank in scouting (Eagle Scout or Gold Award), ranks which less than 20 percent of all scouts reach, may be more likely to be oriented towards the ideals of service, discipline, and achievement essential to military officer careers. A sampling of these variables are provided in the following table, though not all are used in this study. The additional variables all offer interesting prospects for future research.

Table 5.4 Extracurricular Activity Variables Derived from CAR.

Variable	Description of Variable Code
VARSITY	High School (HS) Varsity letter winner = 1; Other = 0
TEAMV	Team sport Varsity letter winner = 1; Other = 0
INDV	Individual sport Varsity letter winner = 1; Other = 0
CAPTAIN	HS Varsity sport Captain = 1; Other = 0
ALLSTATE	All-State, District, County, or City athlete = 1; Other = 0
ATHLETE	Significant HS athletic experience (*CAPTAIN* or *ALLSTATE*) = 1; Other = 0
PRES	HS Student Body or Class President = 1; Other = 0
PRESVP	President or Vice-President of Student Body or Senior Class = 1; Other = 0
CLUBP	President of HS club or National Honor Society, Editor of HS publication, Director of HS music group, or President of Church group = 1; Other = 0
JROTC	JROTC, Sea Cadet, or Civil Air Patrol member = 1; Other = 0
JROTCLDR	JROTC, Sea Cadet, or Civil Air Patrol officer = 1; Other = 0
SCOUT	Boy or Girl Scout member = 1; Other = 0
SCOUTLDR	Boy or Girl Scout Unit Leader = 1; Other = 0
EAGLE	Highest Boy/Girl Rank (Eagle Scout or Gold Award) = 1; Other = 0
LEADER	Significant HS leadership experience (*PRES* or Boy's/Girl's State state-wide elected official or *SCOUTLDR* or *JROTCLDR* or *CLUBP* or Captain of team sport) = 1; Other = 0

The admissions database, which includes a wealth of data not mentioned here, represents a very complete picture of midshipmen prior to entering the USNA. Additional items in the applicant data set (such as the Admissions Board Recommendation (RAB), separate ECA for athletics and non-athletic activities, civilian work experience, parent's education/occupation, and Physical Aptitude Exam (PAE) scores) were not used in this study

because complete information was not available for this sample, USNA classes of 1980 through 1985. This notwithstanding, the data include almost every possible aspect of pre-USNA life and may help to explain the success of midshipmen at the USNA and of USNA graduates in the fleet.

C. USNA PERFORMANCE VARIABLES

The creation of the USNA database revealed a plethora of measurements of midshipman performance. While not all variables are used in this analysis, the various measurements merit mention in this section as possible tools for further analysis. The only USNA variable used in the "GRADUATION" models is the criterion for USNA success defined in this study, graduation/commissioning. It is represented in the data set by the binary variable *GRAD*.

The composite measure of USNA performance, the Aggregate Multiple (described in detail in Chapter II), is represented by the variable *AGGMULT*. Midshipmen with higher *AGGMULT* scores are assumed to have acquired a greater stock of human capital and are therefore hypothesized to have a higher likelihood of developing into career naval officers. As described above, the Aggregate Multiple is used to determine the final ranking of midshipmen, the Order of Merit, identified by the variable *OM*, which determines service selection. Similar to the Candidate Multiple, the weighting procedures for the Aggregate Multiple deviated very slightly during the years in question leading to minor inconsistencies in this variable between classes.

A binary variable, *HONORG*, was created from the Aggregate Multiple and Order of

Merit to identify those midshipmen who graduated with distinction--the top 10% of each class--from the USNA. *HONORG* will be used in this research similarly to the high school valedictorian dummy, both in cross-tabulations and marginal effects analysis.

The various components of the aggregate multiple were broken down from NPRDC's midshipman performance files and indirectly through manipulation of the USNA registrar's database. *AQPR* or Academic Quality Point Rating is essentially the cumulative grade point average on a 4.0 scale of a midshipman in all academic courses. *MQPR* or Military Quality Point Rating is the cumulative grade point average in all military areas--military performance, conduct, physical education, PCR scores, and professional development courses--and is assumed to be the best composite measure of a midshipman's Navy-specific human capital.

The registrar's matrix database was programmed to create averages for all midshipmen by groupings of courses. The measures listed in Table 5.5 were created for this study, all on the same 4.0 scale, though not all were used in this analysis.

Table 5.5 Grade Averages by Academic/Performance Area.

Average	Grouping of Courses
COREQPR	All USNA core courses required of all midshipmen regardless of major
ACADQPR	All academic courses not specific to USNA (likely to be found at most leading four-year universities)
PRDVQPR	Professional Development courses only
ENGQPR	Engineering courses only
MTSCQPR	Math and Science courses only
HUMSQPR	Humanities and Social Science courses only
PERFQPR	Military Performance grades only

Average	Grouping of Courses
CONDQPR	Military Conduct grades only
PCRQPR	Professional Competency Review (PCR) grades only
PEQPR	Physical Education courses only

Binary variables were created to represent a midshipman's academic major by the three USNA academic groups. The classification of these variables, *GRI* (engineering), *GRII* (math/science), and *GRIII* (humanities/social sciences), differ slightly from Bowman's classification which excluded the non-accredited General Engineering and General/Physical Science majors from academic groups I and II, respectively. Based on the findings of Bowman (1990), humanities and social science majors are expected to be more likely to develop into "careerists."

One of the more interesting aspects of this thesis is the analysis of midshipman leaders as defined by qualitative measures. Prior research has focused mainly on such quantitative performance measures as discussed above. Midshipmen leaders were grouped into three categories of outstanding achievers or "moral, mental, and physical leaders," using three binary variables.

Top "moral" leaders are those midshipmen who have excelled in military performance throughout their USNA careers, have exhibited exceptional leadership potential, and are thus assigned to first-class midshipman leadership positions within the brigade. Those individuals were grouped into the category of *STRIPER*, representing their leadership uniform insignia

or "stripes," by matching historical USNA hard-copy records with the registrar's database by name and midshipman ID. *STRIPER* includes only those in significant leadership (vice administrative or staff) positions with the rank of Midshipman Lieutenant Commander (4 stripes) or above, plus those Midshipman Lieutenants (3 stripes) in the position of Company Commander. Company Officers are more likely to assign their top leaders to this valuable company position rather than lose them to "out-of-company" battalion or brigade staffs. Additionally, the Company Commander position is assumed to be a better test of an individual's leadership potential than a staff administrative position.[44]

Among the USNA's "mental" or scholarly leaders are the Trident Scholars, first -class midshipmen who, based on their academic achievement and motivation, are selected to pursue extensive independent research in their major field. This exclusive group of scholars are designated by the variable *TRIDENT*, and were identified through a historical record of Trident Scholars. Independent research by CAPT John Bodnar, USNR (Ret.) has revealed that in the short history of the Trident Scholarship program (1963 and on), 6 of the first 48 Tridents later became Admirals, and over half of those who graduated before 1975 (and can thus be assessed for career attainment) were "still wearing a Navy uniform twenty years later

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[44] The same restrictions on the *STRIPER* designation (4 stripes and Company Commanders) is used at the USNA for institutional research on level of minority achievement within the brigade. See Minority Midshipmen Study Group, *Report to the Superintendent on the Status of Minorities in the Brigade of Midshipmen*, (Annapolis, MD: U.S. Naval Academy, 1996).

with over half of those being Captain's uniforms."[45] Bodnar points out that this contradicts opponents to the Trident program who argue that the program develops academic researchers, not naval officers.

The USNA's "physical" leaders include those midshipmen who earned the varsity "N" letter in their first-class year and are designated by the variable *NLETTER*, and was determined through an investigation of historical NAAA records. In addition to the academic and professional development which all midshipmen receive, varsity athletes must endure the intense stress and demands of varsity athletic preparation and intercollegiate competition. The *NLETTER* designation is restricted to those who earn varsity letter in their first-class year due to the high frequency of recruited athletes who letter in their early years and then quit their sport in order to focus on academic or military demands. In addition to greater physical and athletic skills which may or may not enhance an individual's career potential, varsity athletes are assumed to have greater survival and teamwork skills which are critical to a successful naval career. (Interview, CAPT Jeffrey K. Sapp, USN, 1997)

Additional binary classifications for top USNA performers were created through NPRDC's midshipman performance files and the registrar's database. These will be used along with *HONORG* in the initial cross-tabulation analysis, and by proxy to determine the marginal effects of such achievements. The following categories are proxies for cumulative performance over and above the standards set for the Superintendent's, Commandant's, and

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[45] Bodnar, John W. CAPT USNR (Ret.), Trident Scholars: On the Road to Admiral or to CIVLANT?, Unpublished Draft, 1996.

Dean's Lists, which are awarded on a semester basis:

- *SUPELIST* - AQPR greater than or equal to 3.40, Military Performance and Conduct averages equal to an A (4.0), PE average greater than or equal to a B (3.0), and no average by academic group less than a C (2.0).

- *DANTLIST*- AQPR greater than or equal to 2.90, Military Performance average greater than or equal to a B (3.0), Conduct average equal to an A (4.0), and PE average greater than or equal to a B (3.0). Excludes Superintendent's List midshipmen.

- *DEANLIST* - AQPR greater than or equal to 3.40, Military Performance and Conduct averages greater than or equal to a B (3.0), PE average greater than or equal to a C (2.0), and no average by academic group less than a C (2.0). Excludes Superintendent's List midshipmen.

Additional variables not mentioned here have been created in order to track midshipman development by semester, to establish trends and changing interests. While the midshipman performance variables created in this research may exhibit significant multicollinearity when used together, the resulting database more than adequately captures the human capital of midshipmen and is a rich and valuable resource for future researchers in this area. The variables which were selected for use in this analysis are summarized in Table 5.6.

Table 5.6 USNA Performance Variables.

Variable	Description
GRAD	USNA Graduate = 1; Other = 0
AGGMULT	Aggregate Multiple
HONORG	Distinguished Graduate = 1; Other = 0
AQPR	Academic Quality Point Rating (0 - 4.0)

Variable	Description
MQPR	Military Quality Point Rating (0 - 4.0)
ACADQPR	Non-USNA Specific Academic Average (0 - 4.0)
PERFQPR	Military Performance Average (0 - 4.0)
CONDQPR	Military Conduct Average (0 - 4.0)
PRDVQPR	Professional Development Course Average (0 - 4.0)
STRIPER	Brigade Leader = 1; Other = 0
TRIDENT	Trident Research Scholar = 1; Other = 0
NLETTER	Varsity Letter-Winner = 1; Other = 0
SUPELIST	Superintendent's List (by cum avg) = 1; Other = 0
DEANLIST	Academic Dean's List (by cum avg) = 1; Other = 0
DANTLIST	Commandant's List (by cum avg) = 1; Other = 0

D. POST-COMMISSIONING VARIABLES

An officer who stays in the Navy to the O-4 board and is promoted to LCDR within a major URL community is assumed to be a "careerist" and designated by the binary variable *CAREER*. As described above, an officer commissioned into a warfare community who stays in the Navy but does not remain in a URL community is excluded from the "careerist" pool in this study and are coded as non-careerists. This restriction, which affects a small number of officers (approximately 5 percent of those selected for LCDR in this study) who laterally transfer from their URL community, is made due to the USNA's mandate to produce warriors. "The Naval Academy's role is to produce officers with actual warfare specialties."[46]

[46] Larson, 34.

For *CAREER* to equal 1, the following conditions must be met:

- *GRAD* = 1 if the officer graduated from the USNA.
- *NAVYURL*= 1 if the officer is serving in a major URL community at the 0-3 board.
- *STAYER*= 1 if the officer remains in the Navy between the O-3 and O-4 boards.
- *TRANSFER* = 0 if the officer has not transferred to a non-URL community, and thus is still in a major URL community at the O-4 board.
- *PROMOTE* = 1 if the officer is promoted to LCDR.

Several post-commissioning variables are included in the models to control for institutional differences by warfare community or family demographics. These variables were taken from the Bowman-Mehay Officer Promotion History files. An individual's warfare community is coded by the self-explanatory variables, *SWO*, *NSWO* (Nuclear SWO), *SUB*, *PILOT*, and *NFO*. These data are taken from the Officer Promotion History File at the O-3 promotion board, the best proxy for the time of an individual's retention decision. These controls are used to account for the aforementioned potential self-selection bias by warfare community. Officers in more selective communities such as submarine warfare and pilot may be more motivated and possess a greater degree of human capital, and may in fact be more likely to develop into career officers. But on the other hand, they may have better civilian opportunities and thus less likely to become "careerists."

The marital status of an individual, derived from the Officer Promotion History file and measured at the O-3 Board, is coded into four binary variables:

SNC = Single, No Children

SWC = Single with Dependent Children

MNC = Married, No Children

MWC = Married with Dependent Children

Both civilians and military personnel with dependents have consistently been shown to exhibit more stable and productive behavior, and are thus more likely to stay in the military and to be promoted. The marital status variable is obviously time-dependent and may change between the two career decision points in question, at the four-year point and at the 9-10 year point. (Mehay and Bowman, 1996) This being the case, the usefulness of these variables is questionable due to the potential for a shift in the officer's marital status from the retention decision to the promotion decision.

Control variables to account for the fiscal year of an individual's O-4 promotion board are not utilized in the selectivity and human capital models due to collinearity with USNA graduating class. For example, almost all Class of 1980 graduates who stayed in the Navy first appeared before the FY1989 O-4 board together. The sample includes only officers who reached the retention decision point during the Reagan military build-up years (1981-1988) or just after, and are likely to have exhibited consistent retention behavior. In contrast, the sample reached the O-4 promotion point during the period 1989-1994, a period representing the end of the Reagan years and the beginning of the post-Cold War military downsizing. As a result, little variance in career orientation is expected to be related to an officer's year group.

The final post-commissioning variable used in this study is *USNAPER*, which represents the percentage of USNA graduates who served as members of an individual's O-4 promotion board. *USNAPER* is an independent explanatory variable used in this study to analyze potential institutional favoritism during the promotion process. Board membership lists for fiscal years 1985 through 1995, obtained from the Navy's Office of the Judge Advocate General (OJAG), were matched with the USNA alumni directory to calculate this percentage. One would reasonably assume that there is some likelihood of institutional bias in the Navy favoring USNA graduates if a greater differential between the USNA graduate and the overall URL officer promotion rates was found in years when the promotion board membership was over-represented by senior USNA graduates.

Table 5.7 Post-Commissioning Variables.

Variable	Description
GRAD	USNA Graduate = 1; Other = 0
NAVYURL	Major URL Community at O-3 Board = 1; Other = 0
STAYER	Remained on active-duty in Navy between O-3 and O-4 Boards = 1; 0 = Other
TRANSFER	Lateral transfer between O-3 and O-4 Boards to non-URL Community = 1; Other = 0
PROMOTE	Promoted to LCDR = 1; 0 = Other
SWO	Surface Warfare Officer = 1; 0 = Other
NSWO	Surface Warfare Officer (Nuclear) = 1; 0 = Other
SUB	Submarine Warfare Officer = 1; 0 = Other
PILOT	Navy Pilot = 1; Other = 0
NFO	Naval Flight Officer = 1; Other = 0

Variable	Description
SNC	Single-No Children (O-3 Board) = 1; Other = 0
SWC	Single with Children (O-3 Board) = 1; Other = 0
MNC	Married-No Children (O-3 Board) = 1; Other = 0
MWC	Married with Children (O-3 Board) = 1; Other = 0

Early fleet performance models, such as the REP (percentage of valid fitness reports recommended for accelerated for promotion) developed by Neumann are available, but not included in the analysis of the career potential. These variables are not included due to the high likelihood that early indicators of performance will influence an individual's decision to stay in that organization and through a "halo effect" will influence the organization to promote those individuals who display early signs of strong performance. This study is not interested in a path analysis, where such early performance variables have been utilized in prior research and should prove fruitful to future research. (Mehay and Bowman, 1996)

Postgraduate education variables are also excluded from the career models. Despite analysis by Mehay and Bowman which gives strong evidence that officers with postgraduate education (additional accumulated human capital) are significantly more likely to be promoted, graduate education does not appear to be useful in accounting for retention decisions. Strong economic links between graduate education and retention in the form of additional years of service requirement bias any potential relationship. Additionally their use leads to potential selection bias resulting from the characteristics of officers concerned with achievement and therefore likely to pursue graduate education, and the administrative

selection as the Navy selects officers for graduate education on the same criteria its selects for promotion. This study of career potential ignores post-commissioning performance and education, and focuses almost exclusively on early predictors--pre-USNA factors in the selectivity models and USNA factors in the human capital models.

VI. GRADUATION ANALYSIS

A. USNA GRADUATION SAMPLE AND INITIAL ANALYSIS

The sample considered to analyze the effects of selectivity on USNA graduation includes all midshipmen from the Classes of 1980 through 1985 who took the oath of office as midshipmen on Indoctrination Day. All such midshipmen were assigned a six-digit midshipman ID and entered into NPRDC's midshipmen performance files. This data set contains 7,981 observations and 879 variables. Of these 7,981 midshipmen who entered the Academy, 6,017 (or 75.4 percent) graduated as shown below in Figure 2.

The shaded boxes in Figure 2 represent the extent of this analysis. Database restrictions prevent the analysis of candidates who were not offered an appointment or of appointees who chose not to enter the Academy. Furthermore, voluntary and involuntary resignations from the USNA are indistinguishable. Therefore, the results of this "Graduation" analysis are applicable only to actual midshipmen. Any generalization of the results to the greater population of high school graduates, or even of those interested in and/or with the aptitude for USNA life, are limited to the extent that this sample is representative of the greater populations.

The sample of USNA midshipmen in this study, and the variables used in the cross-tabulation and regression analyses are described in Table 6.1.

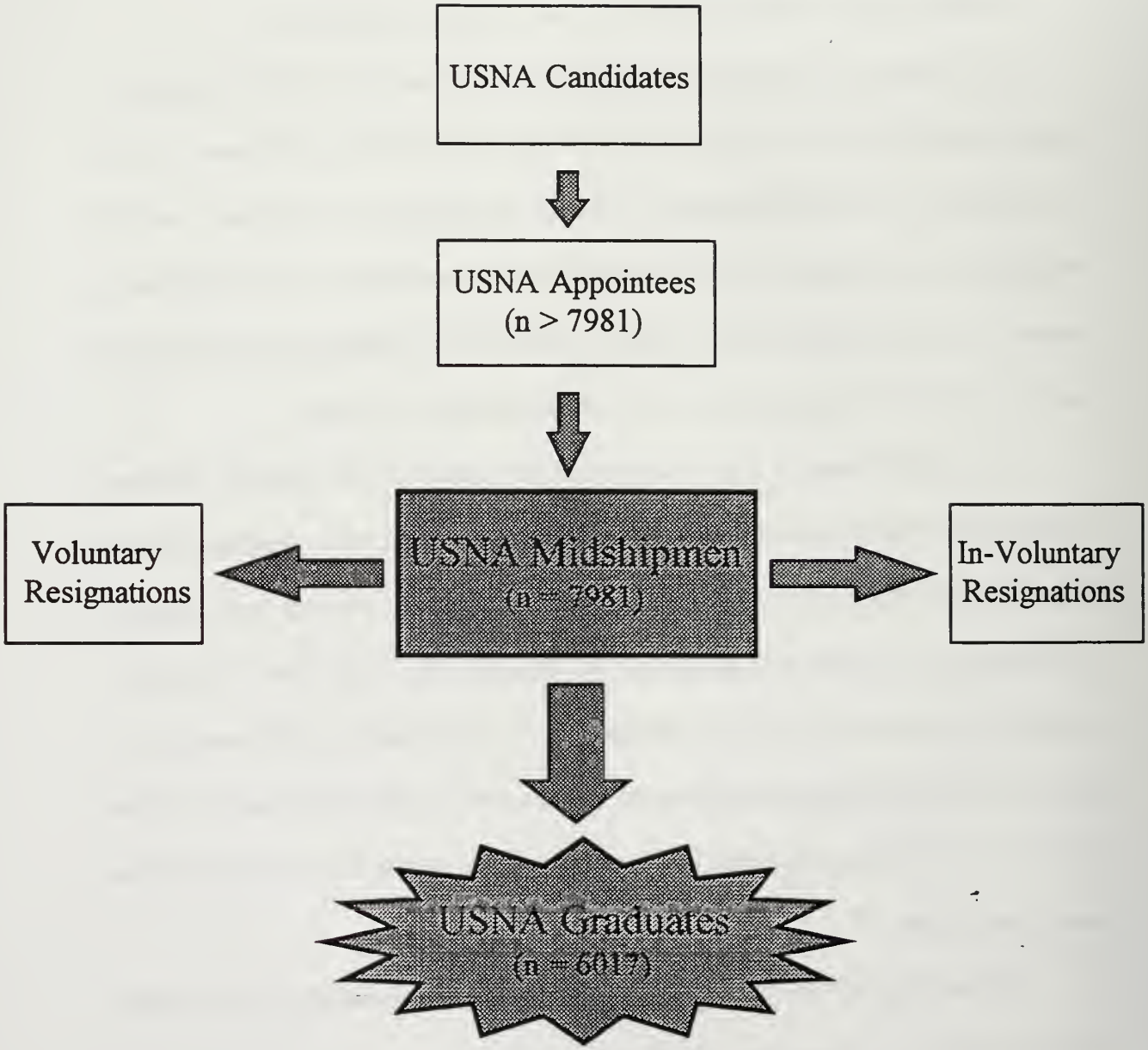

Figure 2. Flowchart of Midshipmen towards Graduation in USNA Graduation Sample

Table 6.1 "Graduation" Analysis Variable Means (Proportions).

Variable	Means	Standard Deviations
MIN1	0.1235	0.3291
FEMALE1	0.0702	0.2554
IDAYAGE	18.580	2.634
MILFAM	0.1877	0.3905
RECRUIT	0.2493	0.4327
PRIORNOM	0.0517	0.2215
CIVPREP	0.2000	0.4000
MILPREP	0.1980	0.3985
CM	63157.4	4010.0
SATMHI	663.4	65.76
SATVHI	575.2	72.24
RC	580.4	108.12
RECS	861.2	109.94
COMPECA	525.5	71.31
DIS	533.1	82.99
NUMBER1	0.0439	0.2635
TOP10CM	0.0984	0.2978
TOP5CM	0.0492	0.2164
TOPHSAT	0.0702	0.2685
ATHLETE	0.3855	0.4868
PRES	0.1387	0.3457
CLUBP	0.2780	0.4000
JROTCLDR	0.0734	0.2608

Variable	Means	Standard Deviations
EAGLE	0.1090	0.3117
LEADER	0.5460	0.4979
CLASS80	0.1621	0.3686
CLASS81	0.1567	0.3725
CLASS82	0.1713	0.3768
CLASS83	0.1762	0.3810
CLASS84	0.1567	0.3636
CLASS85	0.1669	0.3729
GRAD	0.7539	0.4308

In the "GRADUATION" analysis, the variable *GRAD* serves as the dependent variable. This variable has a value of 1 for midshipmen who graduate from the USNA, regardless of branch of commissioned service, and a value of 0 for those who do not graduate (either voluntarily or involuntarily.) Overall, 75.4 percent of those who entered the USNA eventually graduated.

While the data set represents a very robust set of pooled cross-sectional data on USNA midshipmen, this type of data may present problems in the form of serial correlation from the time-series nature of pooled data, as well as heteroskedasticity from the cross-sectional data. The heteroskedasticity is further increased by the nature of binary dependent variables. (Studenmund, 1992) Multicollinearity will be found among a number of the variables, and will be accounted for in the modeling specifications. For example, individuals

with high SAT scores are also likely to have high class rank scores.

The following graphs provide a preliminary analysis of the data in the "GRADUATION" models. USNA graduation (*GRAD*) is cross-tabulated with a number of variables. The figure below indicate the actual percentage of midshipmen in each sub-group who graduated from the USNA. Figure 3 breaks midshipmen down by demographic category, Figure 4 by mental aptitude/USNA potential category, Figure 5 by ECA, and Figure 6 by Candidate Multiple percentile group.

Figure 3 shows that females and minority midshipmen, as well as prior enlisted personnel, graduated at a much lower rate than the USNA average of 75.4 percent. Based on this finding, the null and alternative hypotheses for β_{MIN1} and $\beta_{FEMALE1}$ are specified as the reverse of the selectivity variables' null hypotheses. We expect the coefficient signs to be negative for the minority demographic groups. This specification is additionally supported by a 1993 General Accounting Office report on gender and racial disparities at the USNA. (General Accounting Office, 1993)

The military preparatory schools are charged with "building a level playing field" for such minorities and prior-service personnel, and appear in Figure 3 to have been moderately effective at doing so.[47] As prep school midshipmen appear to graduate at a slightly higher rate than the mean, it will be interesting to see the independent effect of these variables in the

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[47] For further discussion on the roles and performance of the service academy preparatory schools, see General Accounting Office, DOD Service Academies, (Washington, DC: Government Printing Office, 1992); and Moskos, Charles C., and John Sibley Butler, All That We Can Be: Black Leadership and Racial Integration the Army Way, (New York: HarperCollins Publishers, 1996).

Figure 3.

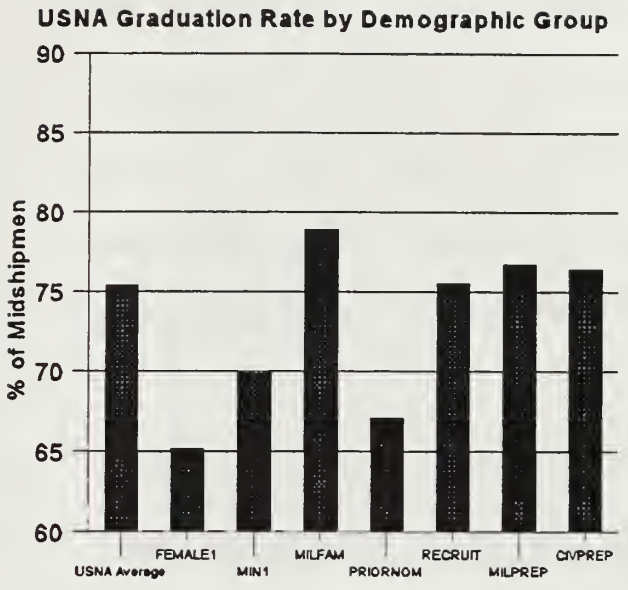


Figure 4.

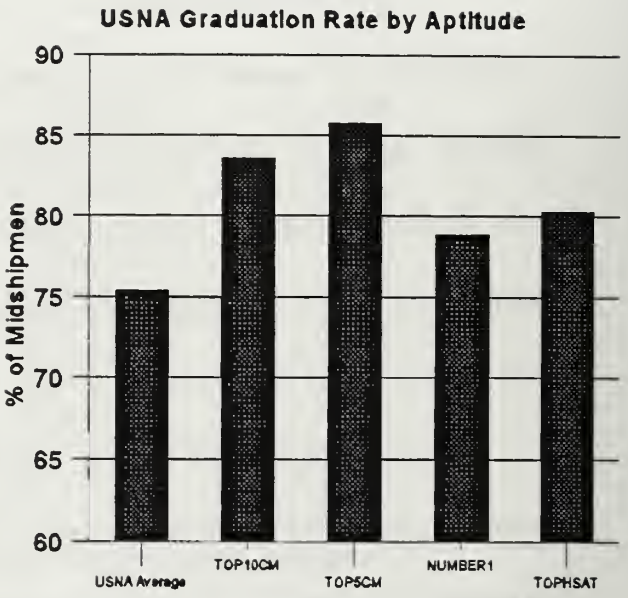


Figure 5.

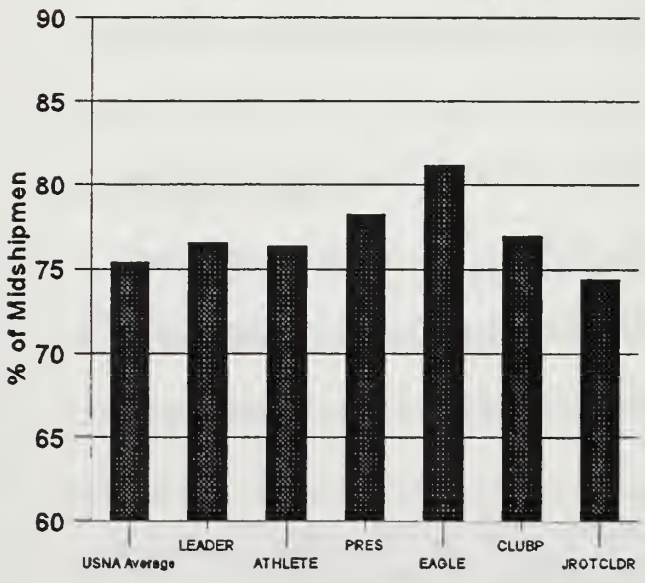
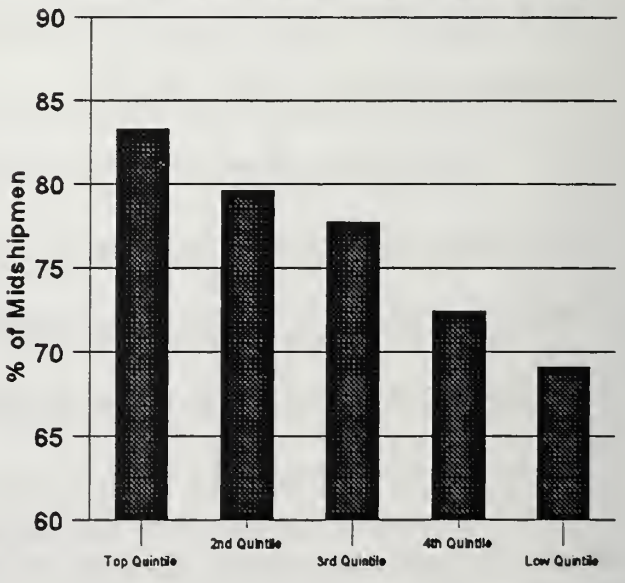


Figure 6.



multivariate analysis.

Figure 4 indicates that the Candidate Multiple, SAT's, and secondary school class rank (as represented by binary variables) all play a role in USNA success, though no conclusions can be gained from this initial analysis. Figure 5 shows that of the superlative ECA categories analyzed, all but *JROTCLDR* graduated at a higher rate than the mean. Most outstanding is the 81.2 percent graduation rate of Eagle/Gold Award Scouts. Figure 6 shows a near linear relationship between the Candidate Multiple, as grouped by quintile, and USNA graduation rate. While this relationship is expected, given the validation efforts of NPRDC analysts, multivariate regression analysis will be required in order to reject the null hypothesis (coefficient less than or equal to 0) and to test the significance of this relationship.

B. "GRADUATION" MULTIVARIATE ANALYSIS

1. "GRADUATION" Model Specification

After having completed this description of the sample populations and the explanatory variables, the exact specification of the estimating models can be described. As explained in Chapter IV, models of the first naval officer development criterion--GRADUATION--can be estimated to examine the selectivity hypothesis and to identify significant early predictors. These models are specified below:

"GRADUATION" Selectivity Model One:

$$\text{GRADUATION} = \alpha_0 + \beta_1\text{MIN1} + \beta_2\text{FEMALE1} + \beta_3\text{MILFAM} + \beta_4\text{PRIORNOM} + \beta_5\text{RECRUIT} + \beta_6\text{CIVPREP} + \beta_7\text{MILPREP} + \beta_8\text{CM} + \beta_9\text{CLASS81} + \beta_{10}\text{CLASS82} + \beta_{11}\text{CLASS83} + \beta_{12}\text{CLASS84} + \beta_{13}\text{CLASS85}$$

"GRADUATION" Selectivity Model Two:

$$GRADUATION = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 SATMHI + \beta_9 SATVHI + \beta_{10} RC + \beta_{11} RECS + \beta_{12} COMPECA + \beta_{13} DIS + \beta_{14} EAGLE + \beta_{15} LEADER + \beta_{16} ATHLETE + \beta_{17} CLASS81 + \beta_{18} CLASS82 + \beta_{19} CLASS83 + \beta_{20} CLASS84 + \beta_{21} CLASS85$$

Model One analyzes the impact of demographics and the composite Candidate Multiple on the probability of USNA graduation.[48] While the *CM* is the USNA's primary selection measurement tool, the reader is reminded of the heavy weight assigned to cognitive skill measures such as SAT's and class rank, which may bias the measure. Essentially, this "Whole-Person" value measure is better classified a "Cognitive + other" multiple. Therefore, it is necessary to evaluate the individual admissions predictors as well.

Model Two builds on the first graduation model by breaking out the weighted Candidate Multiple into its individual components, and by including the USNA disenrollment interest scale and selected binary dummy variables representing outstanding pre-USNA experiences. In this second model, SAT and class rank are grouped into the category of cognitive skills, while recommendations, the disenrollment interest scale, and ECA's are assumed to be affective skills in that they increase the ease of assimilation into the USNA's military environment. The two models thus estimate the effects of overall selectivity and specific selection criteria, respectively, on the probability of USNA graduation.

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[48] The variable *IDAYAGE* is not included in these model specifications due to an extremely high number of missing observations (1,761), which would greatly reduce the "Graduation" sample size in the regression analysis.

2. Results of "GRADUATION" Models

Table 6.1 below shows the results of estimated "GRADUATION" LOGIT models. Due to the presence of random missing data in the Candidate Multiple and other predictor data fields, the regression models captured only 7,849 and 7,841, respectively, of the observations in the sample. This accounts for a respective loss of 1.65 percent and 1.75 percent of the sample, and is not considered to be significant.

The -2 LOG L criterion, from the logistic model, is applied to assess model fit. The χ^2 values range from 256 with 13 degrees of freedom (Model 1) to 306 with 23 degrees of freedom (Model 2). Both models had p-values of 0.0001. Therefore, the null hypotheses of zero explanatory power are rejected, and it is concluded that the models do have some explanatory power. The concordance ratios are 0.623 for the more simple Candidate Multiple model and 0.633 for Model two. The concordance ratio is used as a measure of the predictive accuracy of the model by pairs of responses, and essentially indicates that these models are able to correctly "predict" a *GRAD* response of 0 or 1 for a minimum of 62.3 percent of the observations. (SAS Institute, 1985)

Examination of the linear probability model (results not shown here) provided assurance of the coefficient's level of significance, and provided tests to disprove the presence of troublesome multicollinearity, serial correlation, and heteroskedasticity. Slight, though not troublesome, multicollinearity is found due to the positive correlation between *MILPREP* and *PRIORNOM* (r = 0.32), *ATHLETE* and *RECRUIT* (r = 0.37), *SATMHI* and *SATVHI* (r = 0.38), *SATMHI* and *RC* (r = 0.31), *ATHLETE* and *COMPECA* (r = 0.41), and *LEADER* and

COMPECA (r = 0.37); and negative correlation between *CM* and *RECRUIT* (r = -0.31), and *CM* and *MILPREP* (r = -0.36). High χ^2 values ranging from 412 to 761 in the linear probability model reveal the inherent heteroskedasticity found in cross-sectional data. Heteroskedasticity is the result of the error term variance of the model not being constant, and may lead to an overestimation of the significance of the β coefficients. (Studenmund, 1992)

Table 6.1 shows the β parameter estimates from the two maximum likelihood logistic models of USNA graduation. Significance has been determined by a "one-tailed" analysis of the binary logistic models, utilizing the Prob > χ^2 test statistic. We are able to reject the null hypotheses for all of the selectivity variables in the models with the exception of *LEADER*, *ATHLETE*, and *CIVPREP*. The logistic models show that the following explanatory variables are significant at the 1 percent level: *FEMALE1* (-), *MILFAM* (+), *PRIORNOM* (+) *MILPREP* (+), *SATMHI* (+), *RECS* (+), *COMPECA* (+), *DIS* (+), and *EAGLE* (+). The variables *MIN1* (-), *RECRUIT* (+), and *SATVHI* (+) are significant at the 5 percent level. The reader is reminded that the logistic model does not offer easy interpretation of the β coefficients. They represent the one-unit change in an independent variable, holding all else constant, on the log of the odds of graduation, not on the actual probability itself. More accurate estimates of the marginal effects of changes in these variables are calculated below.

Table 6.2 LOGIT Parameter Estimates for USNA GRADUATION Models.

	Model One	Model Two
INTERCEPT	-4.5245***	-4.7456***
MIN1	-0.1760**	-0.1812**
FEMALE1	-0.7213***	-0.7707***
MILFAM	0.2381***	0.2513***
PRIORNOM	-0.4863***	-0.4002***
RECRUIT	0.1281**	0.1202*
CIVPREP	-0.0223	-0.0438
MILPREP	0.4129***	0.4360***
CM	0.000089***	--
SATMHI	--	0.00214***
SATVHI	--	0.000762**
RC	--	0.00240***
RECS	--	0.000976***
COMPECA	--	0.00172***
DIS	--	0.00158***
EAGLE	--	0.2319***
LEADER	--	-0.0378
ATHLETE	--	-0.00409
CLASS81	-0.0580	-0.0876
CLASS82	0.0602	0.0730
CLASS83	0.0602	0.0616
CLASS84	0.2893***	0.3019***
CLASS85	0.1592*	0.1601*
Concordance Ratio	0.623	0.632

	Model One	Model Two
-2 LOG L	256.415	299.408
Sample Size	7849	7841

Note: *** Significant at the .01 Level (one-tailed test)
** Significant at the .05 Level (one-tailed test)
* Significant at the .10 Level (one-tailed test)

The results indicate that there are many important factors that are associated with the probability of a midshipman graduating from the USNA. The demographic variables show that females, minorities, and prior-enlisted midshipmen are less likely to complete the four-year USNA program, holding all else constant.

As expected, the military prep schools, including NAPS, the Naval Academy Foundation scholarship program, and BOOST, appear to significantly improve a midshipman's probability of graduation. This finding provides support for the efficacy of these programs which, as explained earlier, help to build a level playing field for incoming midshipmen. It appears that what these programs offer in addition to an extra year of academic preparation--additional military development and military socialization prior to the USNA plebe year--explains the differential between the *MILPREP* and *CIVPREP* β coefficients. MILPREP is significantly and positively associated with the probability of graduation, while CIVPREP is insignificant and has a negative coefficient.

The selection criteria employed by the USNA Office of Admissions all, to varying degrees, appear to improve a midshipman's probability of graduation. This finding is expected, given the extensive Candidate Multiple validation efforts by NPRDC utilizing

graduation as one of its criteria.

The coefficients from the LOGIT models are used to calculate the marginal effects of the demographic and selection variables on the probability of USNA graduation. First, the baseline probability of graduation is calculated for the reference (or notional) midshipman. The reference midshipman in both Models One and Two is a Class of 1980 white male who attended neither a military nor civilian prep school, was neither an athletic recruit nor a prior-enlisted servicemember, and was not from a military family. The reference midshipman in Model One had the mean Candidate Multiple score of 63,157, while the reference midshipman in Model Two had the mean score for each individual predictor and was neither a high school athlete nor a leader. The probability of graduation for this "base case" individual was 0.7464 and 0.7474, respectively. The marginal effect is the difference in this probability due to changing the value of the binary dummy variables from 0 to 1 and changes equal to one-tenth of the mean for the continuous variables, while holding all other variables constant. Additionally, marginal effects are calculated for the dummy variables derived from the Candidate Multiple, SAT's, and class rank, by substituting these changes to the base case scores. For example, the marginal effect of *NUMBER1* represents the increase in the probability of graduation for a high school valedictorian with the maximum *RC*, over an individual with the mean *RC* score. Table 6.3 below provides the marginal effects.

Table 6.3 Marginal Effects of Changes in the Explanatory Variables on the Probability of USNA Graduation.

	Model One	Model Two
Reference Probability	74.64 %	74.74 %
MIN1	-3.47 %	-3.57 %
FEMALE1	-15.78 %	-16.95 %
MILFAM	+4.24 %	+4.45 %
PRIORNOM	-10.23 %	-8.26 %
RECRUIT	+2.35 %	+2.20 %
CIVPREP	NS	NS
MILPREP	+7.00 %	+7.33 %
CM	+9.11 %	NS
SATMHI	--	+2.57 %
SATVHI	--	+1.68 %
RC	--	+2.53 %
RECS	--	+1.57 %
COMPECA	--	+1.68 %
DIS	--	+1.54 %
EAGLE	--	+4.12 %
LEADER	--	NS
ATHLETE	--	NS
NUMBER1 *	--	*+8.59 %*
TOPHSAT *	--	*+4.90 %*
TOP10CM *	*+9.59 %*	--

	Model One	Model Two
TOP5CM *	*+10.86 %*	--

Notes: (1) Marginal effects calculated for reference midshipman. (See text.)
(2) * indicates effects of changes in related variables from the mean to achieve a proxy for these variables. (e.g. For *NUMBER1*, *RC* = 800)
(3) All marginal effects are significant at .10 level (one-tailed test) or greater.
(4) NS = Not significant.

Table 6.3 shows, for example, that a ten percent deviation from the mean Math SAT score of 666 to 733 (holding other variables constant) is associated with a positive 2.57 percentage point difference in a midshipman's probability of graduation. This amounts to a 3.4 (.0257 ÷ .7474) percent increase in the probability of graduation.

Of special note are the high negative marginal effects attributed to minority group members (-3.47 and -3.57 percentage points), gender (-15.78 and -16.95 percentage points), and prior military service (-10.23 and -8.26 percentage points), as well as the positive marginal effects of a military family background (+4.24 and +4.45 percentage points), the military prep school experience (+7.00 and +7.33 percentage points), Eagle Scout/Gold Award attainment (+4.12 percentage points), and athletic recruitment (+2.35 and +2.20 percentage points). The top scorers on the Candidate Multiple (*TOP5CM*) and high school class valedictorians, both notable accomplishments, are associated with a positive 10.86 and 8.59 percentage point difference, respectively, indicating 14.6 and 11.5 percent increases in the probability of graduation over the base case midshipman.

Perhaps all of these are expected, with the exception of *RECRUIT*. Conventional

wisdom says that collegiate athletic coaches will take a chance on less gifted student-athletes in order to improve their athletic programs. The data here (significantly positive for *RECRUIT* and not significant for the *ATHLETE* variable) suggest that NAAA coaches are concerned with recruiting student-athletes who not only have the athletic talents to improve their sports programs, but also who are more likely to complete the rigorous four-year USNA program and be commissioned as officers in the Navy and Marine Corps.

Analysis of the individual admissions predictors in Column 2 of Table 6.3 shows that increases in the six primary components of the Candidate Multiple all significantly increase the probability of USNA graduation.[49] As stated above, this finding is expected, as are the greater positive effects of the cognitive/scholastic measure, secondary school class rank, and the cognitive/quantitative aptitude measure, Math SAT. These predictors appear best suited to the technically-oriented USNA academic program. It is clear, however, that **both the cognitive and affective measures of selectivity are important factors in completing the four-year USNA program**.

Given the weighting of the Candidate Multiple, this analysis effectively validates the selectivity hypothesis of this study, as well as the efforts and stated goals of the USNA admissions office. But, as explained above, this study seeks a longer term approach to personnel selection. USNA graduation and commissioning as Ensign in the U.S. Navy is just one step in the development of career naval officers. Given the current near-term approach

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[49] TIS and CIS are not relevant to likelihood of graduation, and thus not included in these models.

of USNA admissions and the time lag between plebe year and promotion to LCDR, findings as significant as this model may not be duplicated in the following models of the effects of selectivity on post-commissioning career potential.

VII. CAREER POTENTIAL ANALYSIS

A. CAREER POTENTIAL SAMPLE AND INITIAL ANALYSIS

The sample used to analyze career potential includes all individuals who graduated from the USNA (*GRAD* = 1), entered a Navy URL officer community upon commissioning (*NAVYURL* = 1), and remained on active duty through the O-3 promotion board (approximately four years.) This restricted data set for the USNA classes of 1980 through 1985 excludes both Marine Corps officers and restricted line/staff corps officers. Of the 6,017 USNA graduates in the Chapter VI analysis, only 5,051 were commissioned as Navy Ensigns. Almost 1,000 of these officers either entered staff, restricted line, General Unrestricted Line (GURL), or other communities, or were separated from the Navy prior to being screened for Lieutenant.[50] Figure 7 below demonstrates this flow. The restrictions resulted in a final sample size of 4,095 for analysis. This sub-set will be used to create the selectivity, and human capital models of "CAREER POTENTIAL."

The shaded boxes in Figure 7 represent the "yield" of career-oriented URL officers from the total supply of URL Lieutenants from the USNA Classes of 1980 through 1985. The results of this analysis, therefore, are applicable only to the USNA graduates in the major URL communities at the O-3 board. No attempt is made to control for the self-selection of officers into the major URL communities. The results of this analysis can

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[50] Data on service selection choices and community designation as Ensigns, as well as data on those who do not screen for Lieutenant is not available for all USNA graduates.

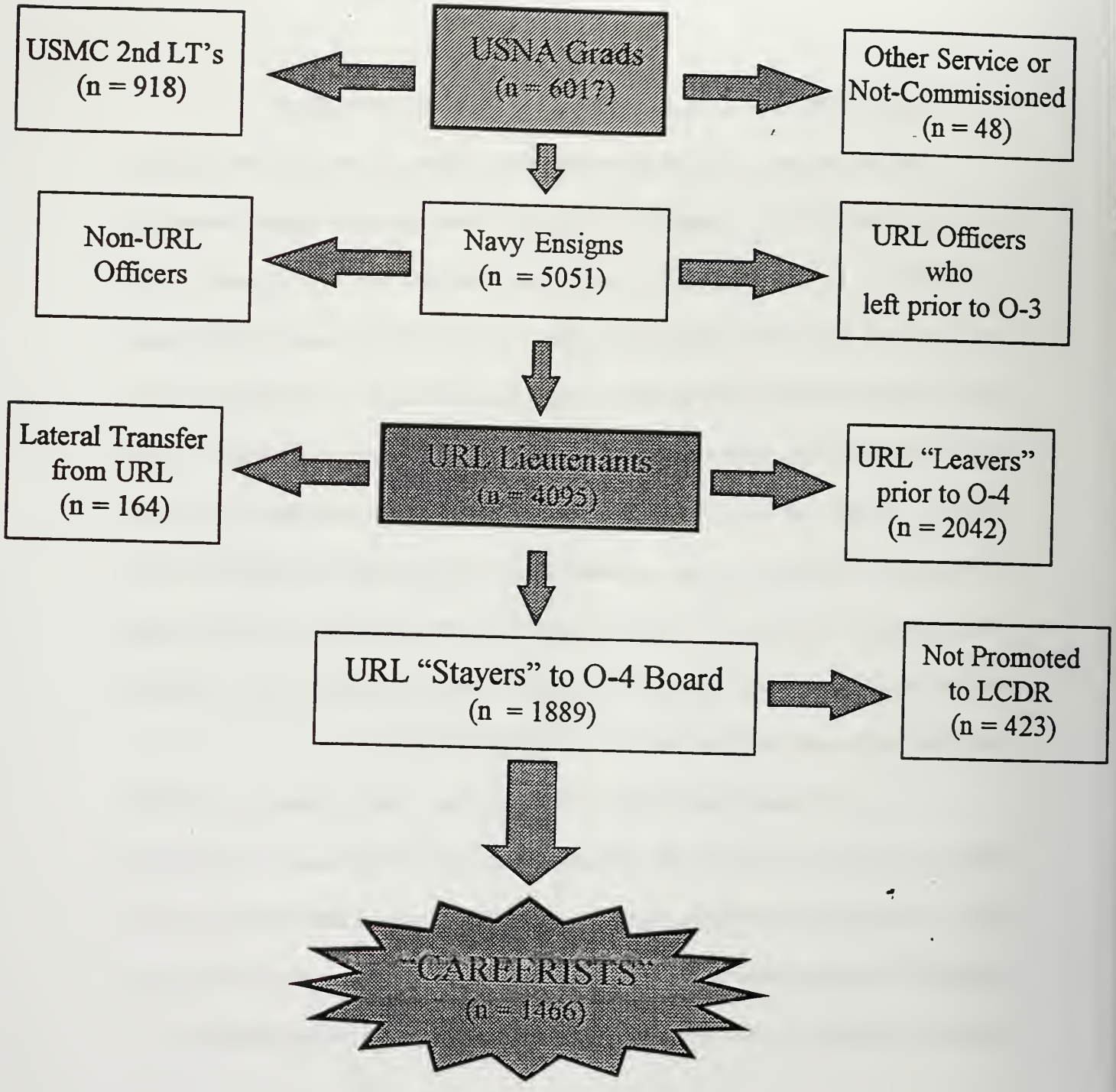

Figure 7. Flowchart of USNA Graduates into Navy URL Sample towards "Careerist" Attainment.

therefore be generalized to other USNA graduates only to the extent that the sub-set of URL officers is representative of Marine officers, and non-URL, Special Warfare, and Special Operations Navy officers. To this end, the characteristics of the following groups of USNA graduates are presented in Appendix B:

- All USNA graduates (*GRAD* = 1);
- Navy graduates in the major URL communities at O-3 (*NAVYURL* = 1);
- Navy graduates not in the major URL communities at O-3 (Staff, Restricted Line, Special Operations, Special Warfare, and officers separated prior to O-3);
- USMC graduates;
- Other graduates (Army, Air Force, or no commission).

Analysis of Appendix B shows that the pre-USNA and USNA characteristics of officers in the major URL communities are noticeably greater than other graduates, indicating a higher level of selectivity and accumulated human capital in this URL sub-set which represents the focus of the USNA's mission.

An additional restriction of this database is shown in Figure 7 by the flow of URL officers who reached the rank of Lieutenant. The study does not attempt to control for the decisions of officers who elect to leave the major URL communities (e.g. transfer from SWO to Engineering Duty Officer (EDO)), who leave the Navy entirely, or who are passed over for promotion to LCDR. The flow out of the Navy accounts for the greatest loss of potential "careerists," 2,042 officers. Only 164 (or 4 percent of the major URL sub-set) laterally transfer, while 423 (or 22.4 percent of those URL officers who stayed to the O-4 board) are

not selected for LCDR. The characteristics of these groups of officers (major URL, "careerists," "leavers," lateral transfers, and non-promotees) are presented in Appendix C. Most noteworthy from Appendix C is that while the pre-USNA selection characteristics of the "careerist" group is below the sample mean, their USNA performance characteristics are superior to all other groups. This suggests perhaps that "careerists" are a cut above other junior URL officers in terms of motivation, and that the Navy is retaining and promoting the top USNA graduates. These decisions in Figure 7, however, are indistinguishable in the joint retention/promotion analysis of the progression from Lieutenant to career officers.

Finally, Figure 7 shows that the "yield" of "careerists" from the original 4,095 Navy URL Lieutenants from the Classes of 1980 through 1985 is 1,466 officers, or 35.80 percent of the USNA graduates in this sub-set. Table 7.1 below presents the means and standard deviations of all variables which are used for analysis of the URL sample.

As stated above, *CAREER* is the dependent variable in the analysis of career potential and has a value of 1 for the nearly 50 percent of URL Lieutenants who remain in the Navy between the O-3 and O-4 boards (*STAYER*) and the nearly 80 percent whom are promoted to LCDR (*PROMOTE*) in a major URL community. Of the 164 officers excluded from the category of "careerists" laterally transferring from the URL, 135 officers (or 82.3 percent of the lateral transfers) were promoted to O-4. Overall, this accounts for a loss of just over 8 percent of the officers promoted to LCDR.

Table 7.1 "Career Potential" Analysis Variable Means (Proportions).

Variable	Means	Standard Deviations
MIN1	0.1006	0.3008
FEMALE1	0.0171	0.1296
GRADAGE	22.44	2.26
MILFAM	0.2049	0.4037
RECRUIT	0.2376	0.4257
PRIORNOM	0.0381	0.1914
CIVPREP	0.2068	0.4051
MILPREP	0.1834	0.3870
CM	63,663.2	3917.8
SATMHI	671.9	64.44
SATVHI	579.3	70.14
RC	589.3	106.56
RECS	860.6	109.34
COMPECA	526.1	71.21
CIS	526.4	93.22
NUMBER1	0.0474	0.2125
TOP10CM	0.1182	0.3229
TOPHSAT	0.0901	0.2864
ATHLETE	0.3773	0.4848
PRES	0.1414	0.3485
CLUBP	0.2752	0.4467
EAGLE	0.1258	0.3316
JROTCLDR	0.0723	0.2590

Variable	Means	Standard Deviations
LEADER	0.5397	0.4985
AGGMULT	1039.1	147.14
AQPR	2.823	0.448
MQPR	3.087	0.358
ACADQPR	2.777	0.448
PRDVQPR	3.040	0.423
PERFQPR	3.173	0.555
CONDQPR	3.761	0.357
GRI	0.4293	0.4950
GRII	0.4063	0.4912
GRIII	0.1641	0.3708
STRIPER	0.1082	0.3106
TRIDENT	0.0049	0.0697
NLETTER	0.1343	0.3410
HONORG	0.1128	0.3164
SUPELIST	0.0171	0.1296
DANTLIST	0.0713	0.2574
DEANLIST	0.1094	0.3122
CLASS80	0.1553	0.3622
CLASS81	0.1736	0.3788
CLASS82	0.1790	0.3834
CLASS83	0.1790	0.3788
CLASS84	0.1565	0.3634
CLASS85	0.1648	0.3711

Variable	Means	Standard Deviations
SWO	0.4613	0.4589
NSWO	0.0425	0.2017
SUB	0.2503	0.4332
PILOT	0.2444	0.4298
NFO	0.4613	0.3680
SNC	0.5416	0.4983
SWC	0.0037	0.0604
MNC	0.3651	0.4815
MWC	0.0896	0.2857
STAYER	0.4613	0.4986
LATRANS	0.0400	0.1961
USNAPER	0.3445	0.0551
CAREER	0.3580	0.4795

Like the "Graduation" data set in Chapter VI, this sample represents a very robust set of pooled cross-sectional data. And like the previous data set this data may introduce problems of serial correlation from the time-series nature of pooled data, and heteroskedasticity from the cross-sectional data. (Studenmund, 1992) Correlation is even greater among a number of these variables given the focus of the USNA on academics, increasing the potential for multicollinearity. For example, midshipmen with higher academic grades are obviously likely to have higher averages by subject area, and stripers are selected primarily on the basis of their military performance grades, and at least in part on academic

performance.

1. Initial Selectivity and Human Capital Analysis

An initial analysis of the "CAREER POTENTIAL" data samples is presented below. Cross-tabulations of "careerist" and selected variables indicate the percentage of Navy URL Lieutenants who developed into career naval officers for various sub-groups. Essentially, the following bar graphs represent the "careerist yield rate" within a given category of URL officers. Figure 8 breaks the sample down by demographics, Figure 9 by selection criteria, Figure 10 by USNA performance, and Figures 11 and 12 by Candidate Multiple and Aggregate Multiple percentile groups.

Figure 8 shows that career development varies greatly by demographic group. Females and minorities appear to lag behind their peers in terms of career development, leading again to the expectation of negative signs for their coefficients in the multivariate analysis. In contrast, officers from military families and prior-enlisted personnel develop into "careerists" at a higher rate than the USNA average of 35.8 percent. This is perhaps due to their early orientation to military life. Officers from prep schools also appear to be more career-oriented. This again begs the question of why minority officers, who are more likely to attend military prep schools, do not develop into career officers at a comparable rate.[51]

As expected, officers with the superlative measures of the USNA selection criteria in Figure 9, with the notable exception of *TOPHSAT*, all appear to increase the "careerist" rate

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[51] For a more detailed analysis of the development of minority naval officers, see Bowman, William R. and Stephen L. Mehay, Career Advancement of Minority Officers in the U.S. Navy, (Paper presented at the 1996 Western Economic Association Annual Conference, 1996).

Figure 8.

"Careerist" Yield Rate by Demographic Group

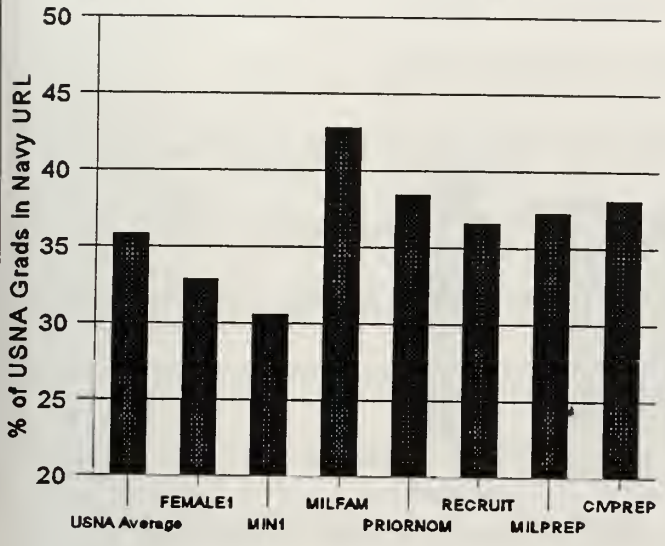


Figure 9.

"Careerist" Yield Rate by Selection Criteria

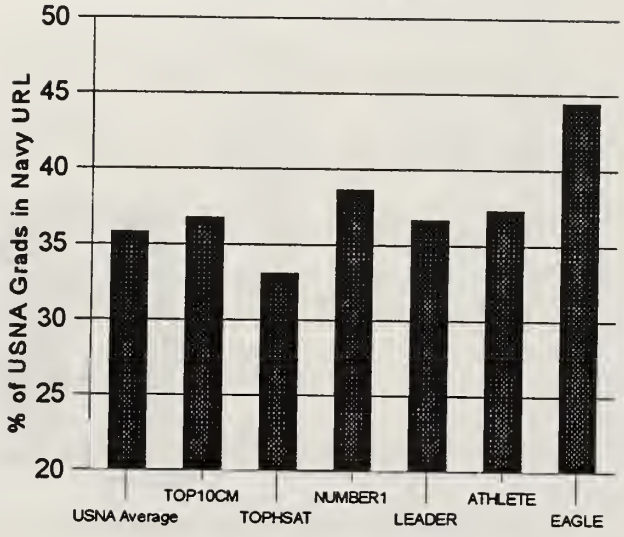


Figure 10.

"Careerist" Yield Rate by Performance Criteria

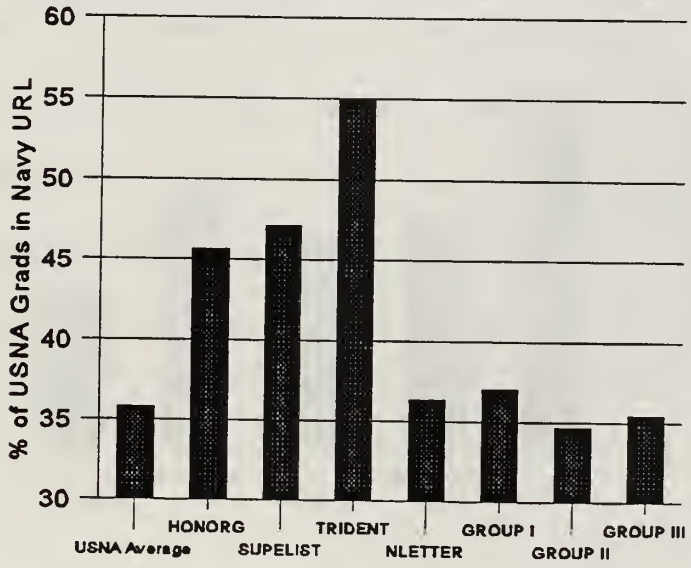


Figure 11.

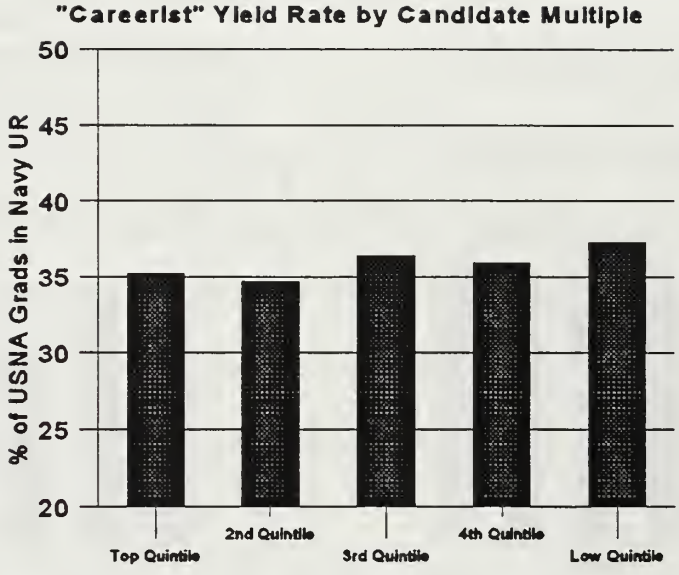
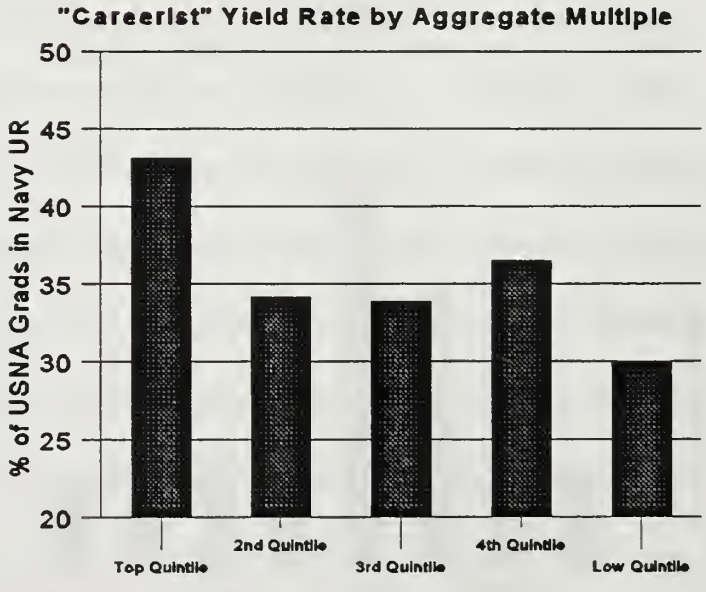


Figure 12.



of USNA graduates to some degree. In addition to the below-average category of high SAT scorers, it is worth noting the extraordinarily above-average "careerist" yield rate for Eagle/Gold Award Scouts, 44.5 percent.

The top measures of USNA performance in Figure 10 also appear to benefit the career development of its graduates, again as expected. Most outstanding is the 55 percent "careerist" yield rate of Trident Scholars, who, though they represent an extremely small sample size (n = 20), appear to be very successful in the fleet. Some minor variation in career development is seen by academic major, though its significance is unclear.

The grouping of USNA graduates by Candidate Multiple quintile in Figure 11 does not reveal any trends. In fact, the highest careerist rate is seen by the lowest 20th percentile of USNA candidates--37.3 percent. Aggregate Multiple as well does not offer any clear trends, except at the extremes. The highest quintile of midshipmen become "careerists" at a rate well above the USNA average, while the lowest quintile develop at a rate well below the average. Between the two extremes, no obvious trends are revealed.

At this point it is worth noting an interesting phenomenon in the analysis of career potential. As explained above, the "careerists" in this study must display both retention and promotability behaviors. A quick glance below at Table 7.2 applied to two distinct groups--prior-enlisted personnel and USNA varsity letter-winners--shows that these two behaviors are very different.

Table 7.2 Analysis of Retention vs Promotability Behavior.

	PRIORNOM	NLETTER	TOTAL SAMPLE
RETENTION RATE (*STAY*)	57.69%	48.73%	50.13%
PROMOTION RATE *(PROMOTE)*	72.22%	82.84%	77.98%
"CAREERIST" RATE (*CAREER*)	38.46%	36.36%	35.80%

While prior-service personnel stay to the LCDR board at a rate of almost 60 percent, their overall careerist rate is only marginally higher than USNA letter-winners. In contrast, while letter-winners stay at a below-average rate, varsity athletes who do stay are promoted at much higher rate than the USNA graduate average. While this may be perceived as a limitation in this analysis, the Navy is concerned with more than the rate at which officers choose to make the Navy a career. It is also concerned with choosing (and promoting) the very best people for its career officer force. The ability of the "careerist" measure to capture this joint retention/promotion phenomena enhances the value of this research to the Navy.

2. Initial Institutional Favoritism Analysis

This study seeks to investigate the possible presence of institutional favoritism or bias at the O-4 promotion board. Members of statutory promotion boards are selected to serve on boards on the basis of their career performance and experiences, and are selected in order to represent a diverse and heterogeneous officer corps. The guiding precepts of the promotion boards for the period in question were examined for possible bias. No evidence of preferential treatment for any individual group of officers was found, with the exception

of a statutory requirement that officers with Joint Professional Military Education (JPME) or experiences be promoted at a rate not less than the overall URL promotion rate. (Department of the Navy, 1986-1995)

The members of the board, listed on the precepts, were then examined for their commissioning sources to determine whether an over- or under-representation of USNA graduates biased the promotion process in any way. For the period in question, USNA representation on the URL LCDR boards ranged from a low of a 28.57 percent in FY1991 to a high of 42.86 percent in FY1990 and FY1993. Such USNA representation by senior officers (O-6 and above) appeared neither extraordinarily high or low when compared to historical representation of USNA graduates in the Navy URL communities at the grades of O-6 and above.[52]

The next step was to look at the LCDR promotion rates for these years for USNA graduates and all URL officers to determine if any relationship existed. Officer promotion is driven by Navy requirements at the higher level and by vacancies at that higher grade. Promotion opportunities thus vary slightly from year to year. As a result of this dynamic, promotion opportunity for individual groups can only be analyzed relative to other groups or to the overall rate for that given year. Table 7.3 below presents the promotion rates for USNA graduates and the overall promotion rates for the primary years of this study in order to explore possible bias.

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[52] As of December 1996, USNA graduates made up 25.0 percent of URL LCDR's, 31.5 percent of URL CDR's, 37.3 percent of URL CAPT's, and 48.8 percent of URL Flag officers. Statistics obtained from USNA Office Of Institutional Research.

Table 7.3 U.S. Navy Active URL LCDR Promotion Boards (FY1990-FY1995).

	FY90	FY91	FY92	FY93	FY94	FY95
Board Members (USNA%)	42.9%	28.6%	35.7%	42.9%	35.7%	29.4%
USNA Promotion Rate	0.790	0.834	0.818	0.845	0.709	0.730
Total URL Promotion Rate	0.764	0.754	0.781	0.775	0.707	0.703
Differential Promotion Rate (USNA - Total URL)	0.026	0.080	0.037	0.070	0.002	0.027

Analysis of this table shows no readily apparent trends, though we are limited to only six year's of data. A statistical t-test for correlation between the USNA Board representation and the differential promotion rates revealed no signs of a significant relationship. In fact, the greatest differential between USNA promotion rate and the rate for all URL officers is seen in FY1991, when the percentage of USNA graduates on the board is the smallest of the six years in question. If anything, this one year indicates the possible inverse of the institutional favoritism theory which predicts that USNA graduates are promoted at a higher rate than their peers on the basis of the over-representation of senior USNA "ring-knockers" on the board. Further analysis will be required before any significant conclusions can be reached regarding the presence in the Navy of a bias favoring USNA junior officers.

B. "CAREER POTENTIAL" MULTIVARIATE ANALYSIS

1. Selectivity Model Specification

The selectivity models of "Career Potential" are now able to be better specified after

having completed a full data description of the Navy URL Lieutenant sub-set of USNA graduates and an initial cross-tabulation analysis of the USNA selection criteria.

Selectivity Model One:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 CM + \beta_9 CLASS81 + \beta_{10} CLASS82 + \beta_{11} CLASS83 + \beta_{12} CLASS84 + \beta_{13} CLASS85 + \beta_{14} GRADAGE + \beta_{15} NSWO + \beta_{16} SUB + \beta_{17} PILOT + \beta_{18} NFO + \beta_{19} SWC + \beta_{20} MNC + \beta_{21} MWC$$

Selectivity Model Two:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 SATMHI + \beta_9 SATVHI + \beta_{10} RC + \beta_{11} RECS + \beta_{12} COMPECA + \beta_{13} CIS + \beta_{14} EAGLE + \beta_{15} LEADER + \beta_{16} ATHLETE + \beta_{17} CLASS81 + \beta_{18} CLASS82 + \beta_{19} CLASS83 + \beta_{20} CLASS84 + \beta_{21} CLASS85 + \beta_{22} GRADAGE + \beta_{23} NSWO + \beta_{24} SUB + \beta_{25} PILOT + \beta_{26} NFO + \beta_{27} SWC + \beta_{28} MNC + \beta_{29} MWC$$

Selectivity Models One and Two estimate the effects of selectivity on the probability of an officer in the USNA graduate sample developing into a "careerist." The models are similar to the graduation models, and similarly account for the skewed nature of the Candidate Multiple. First selectivity is measured as a weighted composite factor, and in Model Two selectivity is modeled by a number individual predictors. Post-commissioning controls are added to the models, and the USNA Disenrollment Interest Scale is replaced by the more relevant Career Interest Scale in Model Two. The definition of the base case is expanded here to include the average graduation age of 22.44, the Surface Warfare community and Single No Children (*SNC*) marital status, both measured at the O-3 board.

2. Results of Selectivity Models

Table 7.4 below shows the results of the estimated selectivity LOGIT models of "Career Potential" for Navy URL officers. The presence of missing data fields in the sample restricted the observations in the models to 4,030 and 3,955 officers, respectively. The -2 LOG L criterion, from the logistic model, are applied to assess model fit. The χ^2 values ranged from 119 with 21 degrees of freedom to 153 with 29 degrees of freedom, both with p-values equal to 0.0001. Therefore, the null hypotheses of zero explanatory power for the models are rejected. The predictive accuracies of the models are estimated using concordance ratios, 0.600 for the more simple composite multiple model and 0.614 for the individual predictor model.

The linear probability models are again analyzed (results not presented here) to test for significant specification errors in the form of multicollinearity, heteroskedasticity, or serial correlation, and to ensure that the coefficients have signs and levels of significance consistent with the LOGIT models for one-tailed tests. Some multicollinearity is found in these models due to similar correlation between the variables as was seen in Chapter VI's "GRADUATION" models. Again, this slight multicollinearity, indicated by Variance Inflation Factors (VIF's) < 2 and relatively low simple correlation coefficients (no r's greater than 0.42), is assumed not to bias the models in any way. As with the "Graduation" models, however, the high χ^2 values ranging from 336 to 651 and Prob>χ^2=0.00001 reveal inherent heteroskedasticity common to cross-sectional data, leading to a possible overestimation of the coefficients in the linear probability models. (Studenmund, 1992)

The selectivity models show that the following variables are significant at the 1 percent level: *MILFAM* (+), *COMPECA* (+), *EAGLE* (+), *PILOT* (+), *NFO* (+), and *SUB* (+). At the 5 percent level *MINI* (-), *GRADAGE* (+), *SATMHI* (-), and *CIS* (+) are significant. *SATVHI* (+) is significant at the 10 percent level. Table 7.4 shows the parameter estimates and level of significance across the two selectivity models. Additionally, model results by warfare community are presented in Appendices D-G.

The results in Table 7.4 indicate that a number of the selectivity factors are significantly related to the probability of an officer developing into a "careerist." First looking at demographics, minority status is negatively associated with becoming a "careerist" whereas military family status is positively associated with the "careerist" measure. A possible explanation for this is an extraordinarily high taste for military life among individuals raised in a military environment, and a below average taste for military life among minority households. As expected, the age at graduation of an individual is significant and positive. Labor economics statistics consistently show that older individuals are more stable and career-oriented in their decision-making. Marital status of officers does not appear to be significant, though the reader is reminded that marital status is observed at the 4 year point of an officer's career and is likely to change between the timing of the retention and promotion decisions. This time lag makes the validity of the marital status dummy variables questionable.

Table 7.4 LOGIT Parameter Estimates for Selectivity Models of Career Potential.

	Model One	Model Two
INTERCEPT	-1.5096**	-2.5062***
MIN1	-0.2555**	-0.2216**
FEMALE1	-0.1586	-0.1952
MILFAM	0.3689***	0.3744***
PRIORNOM	0.0877	0.1612
RECRUIT	0.0407	-0.0112
CIVPREP	0.00316	0.00498
MILPREP	0.0269	-0.0160
GRADAGE	0.0324**	0.0297**
CM	-0.00000386	--
SATMHI	--	-0.00117**
SATVHI	--	0.000821*
RC	--	-0.00047
RECS	--	0.000014
COMPECA	--	0.00203***
CIS	--	0.000672**
EAGLE	--	0.3150***
LEADER	--	-0.0231
ATHLETE	--	*0.0261
CLASS82	0.1694*	0.1122
CLASS82	0.1652*	0.1178
CLASS84	0.0500	-0.0200
CLASS84	-0.2663**	-0.3132***
CLASS85	-0.0185	-0.0768

	Model One	Model Two
NSWO	0.0684	0.0173
SUB	0.2516***	0.2871***
PILOT	0.5153***	0.5073***
NFO	0.7128***	0.6872***
SWC	0.0179	0.0217
MNC	0.0574	0.0318
MWC	0.1415	0.0931
Concordance Ratio	0.600	0.614
-2 LOG L	118.709	152.763
Sample Size	4030	3955

Note: *** Significant at the .01 Level (one-tailed test)
** Significant at the .05 Level (one-tailed test)
* Significant at the .10 Level (one-tailed test)

The Candidate Multiple has no significant effect on career potential, while a number of the individual predictors have significant effects. Despite the level of significance of *SATMHI*, its negative coefficient does not agree with the selectivity hypothesis, and we therefore cannot reject the individual null hypothesis for this selection criterion. Indeed, the two most essential cognitive criteria from the "Graduation" analysis, Math SAT and Class Rank, appear to be associated with a decrease in an individual's probability of developing into a career naval officer. This finding is quite unexpected, especially when one considers the high weight given to these criteria by the USNA Admissions Office. If the USNA is actively seeking applicants with strong cognitive abilities, especially quantitative ability, to meet the

needs of a technologically-advanced Navy, we would expect these skills to increase fleet performance. The significantly opposite signs of the Math and Verbal SAT also bring into question the needs of a naval officer, in that math aptitude is more commonly associated with technical abilities and verbal aptitude is more easily associated with managerial abilities.

Two possible explanations can be applied to the significant and positive coefficient of the Eagle Scout/Gold Award Scout. One is that this significant early predictor of career potential is the result of the quasi-military nature of the Boy/Girl Scouts of America, which imbue young men and women with such qualities as service, discipline, loyalty, and citizenship. But this finding more likely indicates that individuals with a drive for high achievement and lofty goals early in life are most likely to display the same character traits in their military careers as well.[53]

Significantly positive results are found for the Verbal SAT and composite ECA score, though their positive marginal effects (seen below in Table 7.5) are not great. ECA scores and verbal aptitude are assumed to be affective measures of an individual's ability to inter-relate, communicate, and cooperate with others in a military team environment. **Despite the technical orientation of today's Navy, it does appear from this analysis that management and "people" skills are essential to a successful military career.**

The "Career Potential" models attempt to control for self-selection among warfare communities by including community control dummies. As explained in Chapter II, USNA

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[53] According to the Boy Scouts of America, less than twenty percent of scouts who ever join a Boy Scout troop will eventually earn the Eagle Scout award.

graduates select among warfare communities in their first-class year on the basis of their individual choice and relative class standing. Therefore, individuals in the highly selective aviation and nuclear communities are likely to exhibit both higher observed (e.g. SAT scores, class rank) and non-observed factors (e.g. motivation, perseverance, desire to succeed) associated with success as a military officer. Thus, it is not surprising to see the positive and significant coefficients for the more selective warfare community dummies. A positive selection bias may also be evident in the models by warfare community as the result of strictly economic factors. Officers in the aviation communities incur a greater minimum service requirement and are given monthly career incentive pay to offset their marketability in the civilian labor market. Nuclear-trained officers (both submarine and surface) are also offered substantial nuclear bonuses at several career points in order to encourage retention. As a result of such incentives, the highly significant and highly positive impact of being in the NFO, pilot, and submarine communities is expected. It is somewhat unexpected not to see such effects among the nuclear SWO's, whose officers are similarly more selective and receive the same bonuses as their peers in the submarine community. The lack of significance for *NSWO* may indicate an overall poorer quality of life and more arduous work conditions and deployments, for all Surface Warfare Officers, both nuclear and conventional.

The results of the selectivity models for the segregated warfare community sub-samples (see Tables D.2 - G.2 in the appendices) are relatively consistent with the aggregate URL models in terms of expected coefficient signs, though less significance among the coefficients is found due to smaller sample sizes. In fact, the only predictor which remains

significantly positive throughout the sub-samples is military family background. Noteworthy deviations from the aggregate model include the significant positive coefficient of *LEADER* and insignificance of *EAGLE* in the SWO models; and the insignificance of Math or Verbal SAT in both the SUB and PILOT models.

The results from the LOGIT models were next used to calculate the marginal effects of the demographic and selectivity variables on probability of becoming a "careerist" as seen in Table 7.5 below. First, the reference probability of graduation is calculated for the reference (or notional) USNA graduate in this sub-set of URL officers. The reference officer in both models one and two is a Class of 1980 single (no children) white male SWO who attended neither a military nor civilian prep school, was neither an athletic recruit nor a prior-enlisted servicemember, and was not from a military family. The reference USNA graduate in model one had the mean Candidate Multiple score of 63,663, while in model two he had the mean score for each individual predictor and was neither a high school athlete nor a leader. Marginal effects were then calculated from these reference probabilities (.2634 and .2700, respectively), given one-unit changes in the binary dummy variables and changes equal to one-tenth of the mean for the continuous variables. Additionally, proxies for the marginal effects of achieving *TOP10CM*, *TOPHSAT*, or *NUMBER1* status are calculated for the reference officer by substituting the appropriate changes to the mean Candidate Multiple, SAT, and class rank. The results of the marginal effects analysis are shown in Table 7.5.

Table 7.5 Marginal Effects of Changes in the Explanatory Selectivity Variables on the Probability of Development into a "Careerist."

	Model One	Model Two
Reference Probability	26.342 %	27.002 %
MIN1	-4.65 %	-4.14 %
FEMALE1	NS	NS
MILFAM	+7.75 %	+7.97 %
PRIORNOM	NS	NS
RECRUIT	NS	NS
CIVPREP	NS	NS
MILPREP	NS	NS
GRADAGE	+0.63 %	+0.59 %
CM	NS	--
SATMHI	--	-1.51 %
SATVHI	--	+0.95 %
RC	--	NS
RECS	--	NS
COMPECA	--	+2.17 %
CIS	--	+0.71 %
EAGLE	--	+6.64 %
LEADER	--	NS
ATHLETE	--	NS
TOP10CM*	*-0.46 %*	--
NUMBER1*	--	*-1.93 %*
TOPHSAT*	--	*-0.33 %*
SWC	NS	NS

	Model One	Model Two
MNC	NS	NS
MWC	NS	NS
NSWO	NS	NS
SUB	+5.16 %	+5.31 %
PILOT	+11.11 %	+10.35 %
NFO	+15.84 %	+14.68 %

Notes: (1) Marginal effects calculated for reference USNA URL graduate (see text).
(2) * indicates effects of changes in related variables from the mean to achieve a proxy for this category.
(3) All marginal effects are significant at the .10 level or greater.
(4) NS = Not Significant.

The model predicts that a ten-percent deviation from the mean Math SAT score (an increase from 672 to 739 while holding all else constant) is associated with a negative 1.51 percentage point difference in a USNA graduate's probability of becoming a "careerist." This amounts to a 5.6 (-.0151 ÷ .27002) percent decrease in the probability of career success. In contrast, having achieved the rank of Eagle Scout increases the probability of an officer developing into a "careerist" by 24.6 percent (+.0664 ÷ .27002) when all other variables in the model remain unchanged.

Of note are the large negative marginal effects attributed to minority ethnic groups (-4.65 and -4.14 percentage points), and the high positive marginal effects of a military family background (+7.75 percent and +7.97 percent) and the Eagle Scout/Gold Award. Also, ten-percent increases in Verbal SAT and ECA composite are associated with increases (+0.95 and +2.17 percentage points, respectively) in the "careerist" probability.

The scouting achievement is especially exceptional when one considers the time lag between the age of Boy/Girl Scouts (11-17) and the LCDR promotion board (31-36). The data thus suggest that this achievement, relative to similar exceptional achievements such as earning all-state awards in a varsity sport or being elected class president, is an outstanding predictor of career potential. Explanation for the phenomenon may be drawn from the time required to achieve Eagle Scout rank. In contrast to virtual "snapshots" of youth potential/achievement such as the SAT, or even election to the position of class president, this achievement goes far towards describing the character and perseverance of an individual.

The reader is however cautioned not to conclude that the Math SAT, or quantitative/technical skills in general, predicts poor fleet performance or retention. The sample considered is a highly select group of USNA graduates in the Navy's unrestricted line. The mean SAT score for this sample of USNA graduates, 672, indicates that the reference USNA graduate ranked near the highest percentile nationally among incoming college freshmen. Similarly, he/she ranked just outside the top quarter of his/her high school class. Thus, the average USNA graduate is a very talented individual, and possesses above average quantitative skills and technical aptitude. The analysis merely suggests that additional signs of quantitative aptitude, over and above this already high mean, decreases an individual's career potential. One cannot apply opposite logic and assume that an officer with a 400 Math SAT score is likely to become an Admiral. He/she is unlikely to be eligible to earn a commission via the USNA or any other commissioning source. Simply stated, the null hypothesis for this selection criterion cannot be rejected. As a result, the theory which stated

that the Math SAT will have a positive impact on fleet performance is not valid.

The extremely high marginal effects of the warfare community variables are attributed to both the self-selection of highly talented and motivated USNA graduates into the more selective communities, and to the economic incentives (offered in all communities except SWO) to stay in the Navy and become "careerists." The economic incentives appear to be especially effective at increasing one's career-orientation in the NFO community (over 50 percent increase in "careerist" probability) where there may be fewer job opportunities in the civilian job market.

The selectivity models show us that the USNA's overall measure of selectivity, the Candidate Multiple, has no impact on fleet performance as measured in terms of career development. This notwithstanding, three of the so-called affective individual predictors, the composite ECA score, Verbal SAT, and the Career Interest Scale, significantly increase the probability of an officer developing into a "careerist." In contrast stand the apparently negative effects of cognitive abilities such as Math SAT and high school class rank. Analysis of these disparate effects of cognitive and affective selectivity measures leads the author to the conclusion, that, for USNA graduates in the major URL communities, **an individual's cognitive abilities as a whole do not increase his/her career potential, yet communication skills and affective skills developed through non-scholastic activities do significantly increase his/her military career potential**.

The USNA's selectivity overall does appear to play a role in officer career development. However, that role appears limited to those criteria which increase the abilities

of an individual to more readily adapt into the Navy team. Additionally, the models validate the positive impact of two early predictors--military family background and Eagle Scout/Gold Award--on long-term career potential, thereby destroying a commonly-held myth that pre-commissioning achievements are unrelated to fleet performance.

3. Human Capital Model Specification

The human capital models of "Career Potential" are fully specified below, given the initial data analysis of USNA performance criteria for the same Navy URL Lieutenant sub-set of USNA graduates.

Human Capital Model One:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 AGGMULT + \beta_9 CLASS81 + \beta_{10} CLASS82 + \beta_{11} CLASS83 + \beta_{12} CLASS84 + \beta_{13} CLASS85 + \beta_{14} GRADAGE + \beta_{15} NSWO + \beta_{16} SUB + \beta_{17} PILOT + \beta_{18} NFO + \beta_{19} SWC + \beta_{20} MNC + \beta_{21} MWC$$

Human Capital Model Two:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 AQPR + \beta_9 MQPR + \beta_{10} STRIPER + \beta_{11} TRIDENT + \beta_{12} NLETTER + \beta_{13} GRI + \beta_{14} GRIII + \beta_{15} CLASS81 + \beta_{16} CLASS82 + \beta_{17} CLASS83 + \beta_{18} CLASS84 + \beta_{19} CLASS85 + \beta_{20} GRADAGE + \beta_{21} NSWO + \beta_{22} SUB + \beta_{23} PILOT + \beta_{24} NFO + \beta_{25} SWC + \beta_{26} MNC + \beta_{27} MWC$$

Human Capital Model Three:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 PERFQPR + \beta_9 CONDQPR + \beta_{10} PRDVQPR + \beta_{11} ACADQPR + \beta_{12} STRIPER +$$

β_{13}TRIDENT + β_{14}NLETTER + β_{15}GRI +β_{16}GRIII + β_{17}CLASS81 +
β_{18}CLASS82 + β_{19}CLASS83 + β_{20}CLASS84 + β_{21}CLASS85 + β_{22}GRADAGE +
β_{23}NSWO + β_{24}SUB + β_{25}PILOT + β_{26}NFO + β_{27}SWC + β_{28}MNC + β_{29}MWC

As discussed in Chapter IV, accumulated human capital is traditionally measured in terms of quantity and quality. Model One captures the composite quantity of human capital with the USNA Aggregate Multiple measure. As explained in Chapter II, the Aggregate Multiple, just like the Candidate Multiple, is heavily weighted to reflect the Academy's emphasis on academics. Therefore it is necessary to break down this measure into its relevant individual components.

Model Two partitions USNA performance, and accumulated human capital, into its two primary components, the Military and Academic Quality Point Ratings. If AQPR and MQPR are assumed to measure the quality of human capital, academic major is then assumed to represent the quantity of human capital acquired by midshipmen. Group II (Math/Science) is assumed to be the academic major group for the reference midshipman. This approach follows the theory used by Bowman in his test of the Rickover hypothesis. (Bowman, 1990) Additionally, this model incorporates the qualitative performance measures described in Chapter V as dummy variables. Dummies such as *STRIPER* and *NLETTER* are also assumed to the be a measure of an individual's quantity of human capital. While the model does better identify an individual's strengths and weaknesses, the reader is reminded that the MQPR is itself a composite weighted measure of military performance, conduct, physical education, and academic performance in professional development courses. The professional development courses are additionally included in the AQPR calculation, suggesting the need for the further

partitioned model specifications in Model Three.

An alternative approach to measuring accumulated human capital, introduced by Wise and adopted by Mehay and Bowman in their 1996 graduate education study, is followed in Model Three. Wise's model differentiates two different types of human capital--cognitive skills and affective skills--which help determine relative performance of professional workers. (Mehay and Bowman, 1996) In Model Three above, cognitive abilities are specified by an individual's grade point average in non-USNA specific courses (*ACADQPR*) and academic major. *PRDVQPR* serves as a measure of Navy-specific cognitive skills. Affective skills are described by Mehay and Bowman as "work-related attitudes and attributes such as perseverance, self-discipline, leadership, initiative and the ability to cooperate effectively, especially in the military's team production environment."[54] Military performance, conduct, and the additional qualitative measures, such as *NLETTER*, are assumed in this study to differentiate an individual's affective skills. It is assumed that an individual with higher military performance grades and/or a varsity letter has greater affective skills, and thus would more readily adapt to the military team environment and be more likely to develop into a "careerist."

4. Results of Human Capital Models

The -2 LOG L criterion, from the binary logistic model, was again applied to assess model fit. The χ^2 values ranged from 152 with 21 degrees of freedom to 232 with 30 degrees

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[54] Mehay, Stephen L. and Bowman, William R., Human Capital and Job Performance in a Hierarchical Organization: Evidence from Military Personnel, (Annapolis, MD: U.S. Naval Academy, 1996), 10.

of freedom, both with p-values equal to 0.0001. The null hypotheses of zero explanatory power for all the human capital models are thus rejected. The coefficients of concordance were 0.611 for the more simple Aggregate Multiple model, and 0.631 and 0.638 for the more complex Models Two and Three, respectively, indicating relatively strong predictive accuracy.

Models Two and Three introduce a moderate degree of multicollinearity by partitioning the Aggregate Multiple into its components due to the presence of highly correlated performance criteria. Simple correlation as high as r = 0.75 for *MQPR* and *AQPR* in Model Two, and r = 0.77 between *ACADQPR* and *PRDVQPR*. Such high simple correlation coefficients as these and others between *SUB* and several USNA criteria, as well as between *STRIPER* and military performance and *MQPR*, are an inherent limitation of this sample. Despite the correlation, only moderate multicollinearity is assessed by analysis of the Variance Inflation Factors in the linear probability model. As no variables exceed the generally accepted VIF>5 threshold, the models are accepted as sound due to the inherent nature of the correlations. (Studenmund, 1992)

The multicollinearity can be explained first by the aforementioned inclusion of professional development (PRODEV) courses into both the AQPR and MQPR, but also by a general USNA trend. Top USNA performers tend to excel in all areas of academic performance. This is exemplified by the excessively high and unexpected correlation between grade point averages in the three academic groups--engineering, math/science, and humanities/social sciences--and between averages in the USNA core curriculum and the

AQPR and MQPR measures. For example, the correlation coefficient between the unrelated *HUMSQPR* and *ENGQPR* is 0.519. While correlation such as this potentially increases the standard errors of the individual coefficients and therefore may decrease their level of significance, such multicollinearity does not reduce the explanatory power of the models. (Studenmund, 1992)

Secondly, some simultaneity may be present between explanatory variables, as exemplified by *SUB* and *STRIPER*. The high correlations between submariners and academic performance, and between brigade leaders and military performance, are expected, at least in part due to the fact that these performance averages are utilized to a degree as selection criteria for inclusion in these same groups. The presence of such simultaneity on the right side of the regression equation may bias the individual coefficients but also does not reduce the explanatory power of the overall models. (Studenmund, 1992)

The human capital LOGIT models in Table 7.6 show that the following variables are significant at the 1 percent level: *MILFAM* (+), *AGGMULT* (+), *AQPR* (-), *MQPR* (+), *PERFQPR* (+), *PILOT* (+), and *NFO* (+). At the 5 percent level *GRADAGE* (+), *ACADQPR* (-), and *PRDVQPR* (+) are significant. *RECRUIT* (+), *TRIDENT* (+), and *MWC* (+) vary in their significance at the 10 percent level across the three models. Table 7.6 shows the parameter estimates and level of significance, as determined through one-tailed tests, across the three human capital models for the entire sample of USNA graduates. Appendices D through G present the results for the human capital models by warfare community.

Table 7.6 LOGIT Parameter Estimates for Human Capital Models of Career Potential.

	Model One	Model Two	Model Three
INTERCEPT	-3.2981***	-4.2600***	-3.8150***
MIN1	-0.1224	-0.1126	-0.1151
FEMALE1	-0.1809	-0.2767	-0.3235
MILFAM	0.3853***	0.3784***	0.3845***
PRIORNOM	0.0750	0.0155	0.00420
RECRUIT	0.1288*	0.1146*	0.1300*
CIVPREP	-0.00428	-0.0191	-0.0226
MILPREP	0.1131	0.1061	0.1010
GRADAGE	0.0334**	0.0331**	0.0336**
AGGMULT	0.00155***	--	--
AQPR	--	-0.3264***	--
MQPR	--	1.1434***	--
ACADQPR	--	--	-0.2859**
PRDVQPR	--	--	0.3230**
PERFQPR	--	--	0.6163***
CONDQPR	--	--	-0.0105
GRI	--	0.0289	0.0518
GRIII	--	0.0556	0.0311
STRIPER	--	0.1358	0.0762
TRIDENT	--	0.6194*	0.6289*
NLETTER	--	-0.0326	-0.00500
CLASS81	0.1231	0.1058	0.1176
CLASS82	0.1163	0.0809	0.1384

	Model One	Model Two	Model Three
CLASS83	0.0139	-0.0367	0.0459
CLASS84	-0.3186***	-0.4025***	-0.3492***
CLASS85	-0.0912	-0.1875*	-0.1079
NSWO	-0.1828	-0.2016	-0.2023
SUB	-0.00448	-0.00324	-0.00550
PILOT	0.4408***	0.4157***	0.4151***
NFO	0.6216***	0.6010***	0.6013***
SWC	0.0588	0.0219	0.0133
MNC	0.0669	0.0591	0.0440
MWC	0.1549*	0.1365	0.1228
Concordance Ratio	0.611	0.628	0.635
-2 LOG L	151.560	205.625	223.458
Sample Size	4033	4035	4035

Note: ***Significant at the .01 Level (one-tailed test)
** Significant at the .05 Level (one-tailed test)
* Significant at the .10 Level (one-tailed test)

Analysis of these models reveals that a number of factors, including both cognitive and affective USNA performance measures, are significantly related to the probability of a URL officer developing into a "careerist." Demographics clearly plays a lesser role in these models than in the selectivity models, with neither minorities nor females developing into "careerists" at a significantly higher or lower rate than the base case. This indicates perhaps that the USNA does effectively act as a leveling ground for racial and gender minorities in terms of developing career-oriented officers. It is apparent that the gender or color of a USNA

graduate's skin is insignificant compared to his/her performance at the USNA. This appears to be a very positive sign for the USNA and the Navy, and warrants further analysis.

Despite the insignificance of race and gender, the impact of being from a military family appears to be even greater in the three human capital models. While sociologists have for years discussed the influence of military taste and military socialization in their studies of development of an American military elite, such significant differences are still surprising.[55] Additionally, in all of the models, recruited athletes are associated with a significantly greater likelihood of becoming "careerists." This finding is again unexpected considering the conventional wisdom among academia and intellectual elites that the recruitment of student-athletes brings down the level of education in America's colleges and universities, and that the value of so-called "blue-chippers" to society is limited beyond the athletic arena. The age at graduation of an individual is again significant and positive, as one would expect due to the more stable decision-making processes associated with age. In Model One, the individuals married with children, relative to single officers, are associated with a significantly higher probability of making the Navy a career. This finding appears to be consistent with labor economic theory as to the role of marital status in an individual's retention behavior. Officers with dependents are more likely to appreciate the security of a military career and its benefits and are thus less likely to try to "go it alone" in the civilian labor market. The reader is reminded however, of the limitation of the marital status demographic variables in this study,

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[55] See for example Janowitz, The Professional Soldier, 1960; or Little, Roger W., Handbook of Military Institutions, (Beverly Hills, CA: Sage Publications, 1971).

inasmuch as marital status is observed at the O-3 board and is likely to change prior to the O-4 board.

We see in Model One that, unlike the USNA's composite selection criterion (Candidate Multiple), the composite performance criterion (Aggregate Multiple) is significantly and positively associated with career potential. We thus reject the individual null hypothesis for *AGGMULT*. Yet, before any conclusions about the impact of USNA performance on URL fleet performance can be reached, we must decompose this overall performance score into its components. Model Two is also inconclusive. Quality measures of human capital, AQPR and MQPR, have opposite effects while quantity measures (academic major, leadership, athletic, and academic achievements) are all insignificant with the exception of *TRIDENT*.

As discussed in the model specifications, the Aggregate Multiple is assumed to be the overall measure of accumulated human capital in a midshipman. It includes measures of human capital associated with both cognitive skills (AQPR, academic major, and independent scholastic research) and affective skills (military performance, conduct, leadership, and athletic achievement.)

USNA measures of general cognitive skills appear to be consistent with the null hypothesis of zero or negative impact. An increase in the USNA overall Grade Point Average (GPA), AQPR, is actually associated with a significant decrease in the probability of development into a "careerist." A similar result is found in Model Three for the strictly academic, *ACADQPR*. These findings are not only unexpected, but unreasonable when one

considers the amount of emphasis USNA places on academics. We are therefore not able to reject the null hypotheses for these cognitive measures of human capital. One possible explanation for this phenomenon is that officers with stronger academic records may, on the margin, possess greater and more marketable human capital skills in the civilian labor market and thus be more likely to voluntarily leave the Navy. Another possible explanation is that officers on the margin with a higher degree of cognitive skills, may in fact have a lower amount of the so-called affective skills necessary for a manager in today's military. Obviously, further research is necessary to test these explanations.

Academic major, relative to the base case of a Math/Science major, is insignificant in terms of developing career officers. This finding appears to validate the research of Bowman in disproving Rickover's hypothesis--that engineering majors are better-suited to the technologically-advanced Navy of the late twentieth century. If technical proficiency is needed among the Navy's URL officer corps, it appears that either the USNA's technical core or post-commissioning training is adequately meeting those needs. However, academic major does appear to be significant in the SWO and SUB sub-samples (see Table D.3 and E.3), as humanities/social science majors in the SWO community and engineering majors in the submarine community are associated with a greater probability of career development relative to math and science majors

The high level of career attainment seen among Trident Scholars in the cross-tabulation analysis is found to be statistically significant in all three multivariate models despite their limited numbers (n = 20). There exists such a small frequency of Trident

Scholars, approximately six per USNA class, that no statistical significance was expected. The Trident Scholar, as indicated by its highly positive β coefficient, appears to be an excellent early predictor of URL officer career success, due either to the cognitive aptitude necessary to tackle an independent research project but more likely due to the obvious initiative and strong work ethic involved (affective skills) with such a project.

In contrast to the purely academic variety of cognitive skills, gains in human capital through Navy-specific cognitive skills, as measured by academic performance in the USNA's professional development courses, significantly increase an officer's potential for career success. The PRODEV courses which focus on both the short-term (e.g. navigation and naval engineering) and the long-haul (e.g. leadership) appear to prepare officers for both their junior officer responsibilities as manifest in promotion to O-4 and a career-orientation as manifest in retention to the ten year point. A notable aspect of *PRDVQPR* is its insignificance among the SWO sub-sample and its significantly positive coefficient in the NFO sub-sample (see Tables D.3 and G.3). A reasonable assumption would be to predict a more positive and significant coefficient in the SWO community, given the greater relevance of course material such as navigation and naval science to surface warfare officers. Apparently, more than it is a sign of professional competence, outstanding PRODEV performance may indicate the priority which a midshipman placed in his/her professional development relative to other academic areas.

The primary USNA measure of affective skills, military performance, is shown by the LOGIT analyses to be very significantly and positively associated with career success. These

results are expected, given the military environment and rating structure used to assign semester-by-semester performance grades. Military performance embodies a number of factors--leadership potential, military bearing, teamwork, discipline, dedication, initiative, professional knowledge, and training of subordinates--all of which are readily adaptable to the fleet environment, regardless of warfare community. And similar to performance in professional development courses, military performance average may be indicative of a midshipman's relative prioritization of the USNA's two worlds, military and academic. A midshipman who dedicates himself/herself to being a top performer in his/her company may be more likely career-oriented at an early age and is thus more likely to develop into a career officer.

The insignificance of qualitative affective measures such as *STRIPER* and *NLETTER* in the aggregate URL model may be somewhat misleading. Brigade leaders are selected based on a variety of measures, not the least of which is military performance. This simultaneity, given the relatively high simple correlation between *PERFQPR* and *STRIPER* ($r = 0.40$), may bias the significance of the brigade leadership coefficient. In any case, the positive β coefficient indicates that it may still be an excellent predictor of career success. Additionally, *STRIPER* is positive and significant at the 5 percent level in the PILOT sub-sample. (See Table F.3) As for varsity letter-winners, the reader is reminded that all midshipmen are required participate in athletics on the varsity, club, or intramural level. Thus, all midshipmen theoretically do accumulate some level of affective skills associated with athletic competition such as teamwork, dedication, competitiveness, and fair play. In theory,

athletes competing on the varsity level accumulate a greater stock of human capital through these skills. Yet, in reality, the *NLETTER* status captures athletes in such individual and non-traditional collegiate sports as pistol, rifle, golf, and off-shore sailing. Such sports may in fact rank below club sports such as rugby, boxing, field hockey, and ice hockey (and perhaps even below some intramural sports) in terms of their associated level of competitive drive and teamwork. Further research is recommended to segregate varsity athletes by team and individual sports, or by contact and non-contact sports. Such an analysis may show that the level of cooperation necessary in team sports, and the survival instincts gained from "getting your face kicked in" in contact sports may yield more career-oriented officers.

As in the selectivity models, the human capital models account for warfare community self-selection through dummy variables. Similar results to the selectivity models are seen in the aviation communities where a longer minimum service requirement and incentive pay bias retention behavior relative to SWO's. Yet, no significance is found for either the submarine or nuclear surface community dummies, despite the presence of economic incentives. As with the *STRIPER* variable, the lack of significance in the submarine warfare coefficient may be in part due to a simultaneity bias between *SUB* and USNA performance.

A linear transformation technique was applied to the LOGIT models in order to calculate the marginal effects of the demographic and human capital variables on the probability of becoming a "careerist." The marginal effects analysis are displayed in Table 7.7. The reference officer in both models one and two is a Class of 1980 single (no children) white male SWO, 22.44 years old at graduation, who attended neither a military nor civilian

prep school, was neither an athletic recruit nor a prior-enlisted servicemember, and was not from a military family. He majored in a group II area subject (Math/Sciences). In Model One, he had the mean Aggregate Multiple score of 1,039, while in Models Two and Three, he had the mean grade averages for each individual area and was neither a brigade leader, letter-winner, nor Trident Scholar. Marginal effects are then individually calculated from the reference probabilities, given the following changes:

- changes in the dummy variables from 0 to 1;
- one year increase in graduation age;
- one-tenth of the mean increase for Aggregate Multiple;
- 0.25 point increases in grade averages;
- increases in the associated performance areas (e.g. *AGGMULT*, *MQPR*, *ACADQPR*) necessary for the reference officer to achieve a proxy for *HONORG*, *SUPELIST*, *DEANLIST*, or *DANTLIST*.

As expected, the Military Quality Point Rating, which incorporates Navy-specific cognitive skills and affective skills, appears to achieve the highest marginal gain in probability of career development among all the grade averages in Table 7.7. An 1/4 point increase from the mean MQPR of 3.09 to 3.34, holding all other else constant, is associated with a positive 6.20 percentage point difference a USNA graduate's probability of becoming a "careerist." The probability for the reference officer is thus increased by 22 percent (.0620 ÷ .28822).

Significant and substantial marginal gains in the "careerist" probability are also seen for the officers from military families (+8.40, +8.33, and +8.31 percentage points), and for

Table 7.7 Marginal Effects of Changes in the Explanatory Human Capital Variables on the Probability of Development into a "Careerist."

	Model One	Model Two	Model Three
Reference Probability	28.152 %	28.822 %	27.701 %
MIN1	NS	NS	NS
FEMALE1	NS	NS	NS
MILFAM	+8.40 %	+8.33 %	+8.31 %
PRIORNOM	NS	NS	NS
RECRUIT	+2.68 %	+2.41 %	+2.68 %
CIVPREP	NS	NS	NS
MILPREP	NS	NS	NS
GRADAGE	+0.68 %	+0.68 %	+0.68 %
AGGMULT	+3.37 %	--	--
AQPR	--	-1.64 %	--
MQPR	--	+6.20 %	--
ACADQPR	--	--	-1.41 %
PRDVQPR	--	--	+1.65 %
PERFQPR	--	--	+3.19 %
CONDQPR	--	--	NS
GRI	--	NS	NS
GRIII	--	NS	NS
***HONORG** **	*+9.03 %*	--	--
***SUPELIST** **	--	*+11.26 %*	*+10.57 %*
***DEANLIST** **	--	*+6.24 %*	*+6.12 %*
***DANTLIST** **	--	*+7.89 %*	*+6.37 %*
STRIPER	--	NS	NS

	Model One	Model Two	Model Three
TRIDENT	--	+14.11 %	+14.11 %
NLETTER	--	NS	NS
SWC	NS	NS	NS
MNC	NS	NS	NS
MWC	+3.24 %	NS	NS
NSWO	NS	NS	NS
SUB	NS	NS	NS
PILOT	+9.69 %	+9.21 %	+9.02 %
NFO	+14.03 %	+13.66 %	+13.44 %

Notes:
(1) Marginal effects calculated for reference USNA URL graduate. (See text.)
(2) * indicates effects of changes in related variables to achieve this category.
(3) All marginal effects are significant at .10 level or greater (one-tailed tests.)
(4) NS = Not Significant

increases in graduation age (+0.68 percentage points across all models), military performance (+3.19 percentage points) and professional development averages (+1.65 percentage points), as well as the Aggregate Multiple (+3.37 percentage points). Significant negative effects are the result of increases in the two primary measures of general cognitive skills, AQPR and non-USNA specific academic averages (-1.64 and -1.41 percentage points, respectively).

Most outstanding in the marginal effects of human capital analysis is a positive difference of 9.03 percentage points, or an increase of 32 percent, in the probability of career development attributed to an increase in Aggregate Multiple which moves the reference

individual into the *HONORG* category. Graduating at the top of one's USNA class is truly a significant accomplishment which, in the highly competitive Academy environment, requires dedication to both academic and military development over the course of four years, in addition to obvious skills and talents. Such a sustained dedication to excellence, more than any measure of an individual's cognitive or affective human capital, is clearly an indicator of military career potential. Additionally, this finding appears to disprove any doubts as to whether or not the Navy is retaining the top USNA graduates.

Similar increases are found by increasing the averages of the "base case" to the level of the Superintendent's List (+11.26 and +10.57 percentage points), the Dean's List (+6.24 and +6.12 percentage points), and the Commandant's List (+7.89 and +6.37 percentage points). While positive effects are expected, given the significant and positive effects of gains in the Aggregate Multiple itself, all four achievements require excellence in academic and military areas. As has been shown by this analysis, only the Navy-specific cognitive and general affective skills appear to improve one's chances for career success holding all else constant. Together these gains in academic and military areas account for significant increases in the probability of career development for a URL officer. It is interesting, though, to note the greater positive effects associated with the Commandant's List relative to the Dean's List. Overall, the Dean's List requirements appear to be more stringent, but the higher military performance average required for the Commandant's List appears to be dominant in the marginal effects analysis.

In summary, the human capital models indicate that accumulated human capital gained

by an officer during his matriculation at the USNA plays a significant role in his/her career development. Specifically, **the affective skills and Navy-specific cognitive skills gained by a midshipman over four years increase the probability of USNA graduates in the major URL communities developing into "careerists."** Generic, or academic, cognitive skills, in contrast, significantly decrease this probability, indicating a possible dichotomy between the worlds of academia and the operational Navy. Finally, top overall USNA performance is shown to be an outstanding predictor of fleet success. These findings validate this study's human capital hypothesis, that the USNA's four-years of academic and military preparation increase an officer's potential for fleet success. Additionally, they lend support to the USNA as an institution. While officers from other leading universities commissioned through ROTC or OCS may compare to USNA graduates in terms of academic background, they theoretically pale in comparison with the stock of Navy-specific cognitive and affective skills that have been shown to improve fleet performance over the long-haul.

5. Combined Selectivity and Human Capital Model

Given the relative strengths of the individual selectivity and human capital models in their ability to predict the career success of USNA graduates, the next logical analytical step is to test these effects in the same model. Such a model would ideally determine the dominant explanation for the high level of fleet performance by USNA graduates. In order to reduce the correlation between variables, the two composite multiples are utilized in the model. The Candidate Multiple captures the overall selectivity of an individual, and the Aggregate Multiple incorporates an individual's accumulated cognitive and affective human capital.

Combined Selectivity & Human Capital Model One:

$$\text{Career Potential} = \alpha_0 + \beta_1 MIN1 + \beta_2 FEMALE1 + \beta_3 MILFAM + \beta_4 PRIORNOM + \beta_5 RECRUIT + \beta_6 CIVPREP + \beta_7 MILPREP + \beta_8 CM + \beta_9 AGGMULT + \beta_{10} CLASS81 + \beta_{11} CLASS82 + \beta_{12} CLASS83 + \beta_{13} CLASS84 + \beta_{14} CLASS85 + \beta_{15} GRADAGE + \beta_{16} NSWO + \beta_{17} SUB + \beta_{18} PILOT + \beta_{19} NFO + \beta_{20} SWC + \beta_{21} MNC + \beta_{22} MWC$$

Missing data reduced the sample size of Navy URL Lieutenants from 4,095 to 4,028, a loss of 1.6 percent of the URL sample. The model's -2 LOG L criterion χ^2 value of 159, with 22 degrees of freedom and p-value equal to 0.0001 allows us to reject the model's null hypothesis of zero explanatory power. The concordance ratio is 0.614, indicating a degree of predictive accuracy similar to the previous models. A slight degree of multicollinearity is still found due to the high simple correlation (r = 0.5072) between the Candidate and Aggregate Multiples.

Table 7.8 below shows the results of this combined LOGIT model. Similar to the earlier career potential models, *MILFAM* (+), *MIN1* (-), *GRADAGE* (+), *PILOT* (+), and *NFO* (+) are found to be significant with one-tailed tests. Unlike the earlier selectivity model, however, the Candidate Multiple, holding all else constant, is shown to be significantly (.01 level) and negatively associated with an officer's probability of becoming a "careerist." Such a finding is very unexpected when one considers the value the USNA places on the Candidate Multiple as a selection tool, but becomes more easy to understand when one recalls the individual negative parameter estimates for two of its primary predictors, Math SAT and secondary school class rank. The Aggregate Multiple is again significantly and positively

Table 7.8 LOGIT Parameter Estimates for the Career Potential Model of the Inter-Relationship of Selectivity and Human Capital.

	Model One
INTERCEPT	-1.6630**
MIN1	-0.2045**
FEMALE1	-0.1565
MILFAM	0.3792***
PRIORNOM	0.0271
RECRUIT	0.0528
CIVPREP	-0.0122
MILPREP	0.0496
GRADAGE	0.0332**
CM	-0.00003***
AGGMULT	0.00183***
CLASS81	0.1438
CLASS82	0.1579*
CLASS83	0.0565
CLASS84	-0.2736**
CLASS85	-0.0487
NSWO	-0.1615
SUB	0.0124
PILOT	0.4304***
NFO	0.6192***
SWC	0.0614
MNC	0.0644
MWC	0.1502

	Model One
Concordance Ratio	0.614
-2 LOG L	159.136
Sample Size	4028
Note: *** Significant at the .01 Level (one-sided test) ** Significant at the .05 Level (one-sided test) * Significant at the .10 Level (one-sided test)	

related to fleet success, as expected.

The reference officer in the marginal effects analysis is a Class of 1980 single (no children) white male SWO, 22.44 years old at graduation, attended neither a military nor civilian prep school, was neither an athletic recruit nor a prior-enlisted servicemember, and was not from a military family. Both his Candidate Multiple of 63,663 and his Aggregate Multiple of 1,039 were the means among all USNA graduates in this sample of Navy URL officers. Marginal effects were calculated from the reference "careerist" probability of .2729 first by substituting the mean Candidate Multiple score for each *CM* quintile of the sample, holding Aggregate Multiple constant, and then by substituting the mean Aggregate Multiple score within each *AGGMULT* quintile while holding the Candidate Multiple constant. The resultant probabilities thereby reflect the marginal effects of *CM* and *AGGMULT* variance by percentile, and are presented in Figures 13 and 14 below.

Figure 13 shows the effects of varying the Candidate Multiple while holding USNA performance constant. Essentially, if a midshipman's selectivity is an adequate measure of his/her potential, then this analysis shows the impact of overall potential, given average

Figure 13.

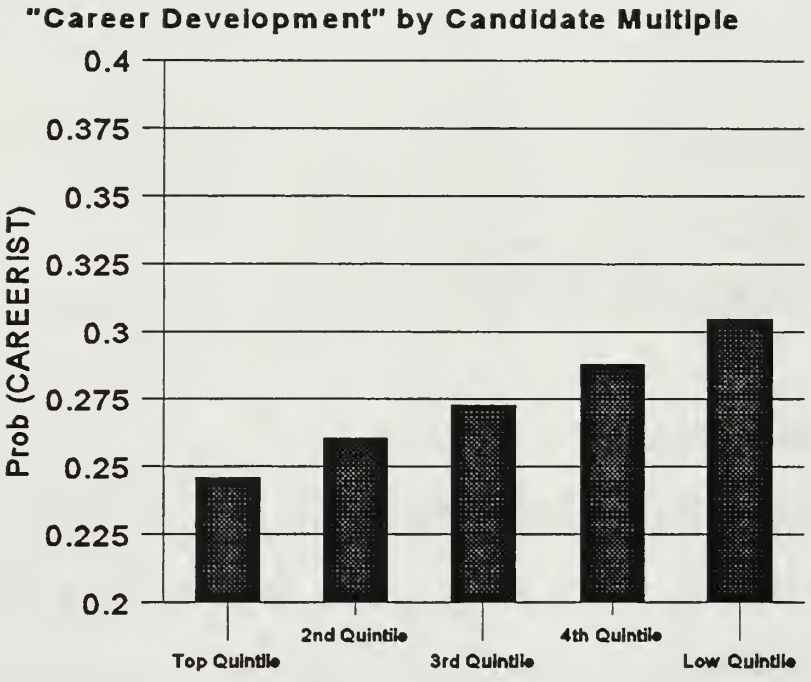
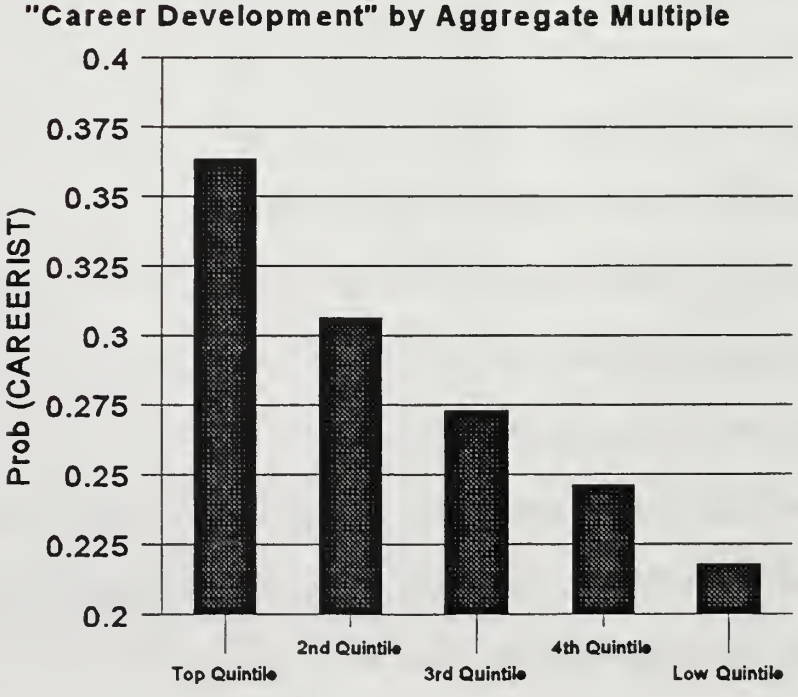


Figure 14.



USNA performance, on the probability of career success in the fleet. On the left, we see a graduate with exceptionally high potential who obviously did not meet his/her expectations at the USNA as a result of lack of motivation or distaste for military life and thus is less likely to meet his/her full expectations as a Navy officer. This observation represents the classic underachiever or "slacker." On the right side of Figure 13, we see a graduate with below-average potential, who through diligence and motivation became an average USNA performer and is likely to carry that motivation and work ethic with him/her into the fleet. His/her "careerist" probability is thus highest (Pr(*CAREER)* = 0.30469) among the "average USNA performers" in Figure 13.

Figure 14 presents a similar analysis with opposite logic. We see the effects of variance in a midshipman's Aggregate Multiple while holding his/her potential (as measured by Candidate Multiple) constant. A USNA graduate who entered USNA with only average potential but finished in the top 20 percent of his/her class is seen on the left, and theoretically represents the classic overachiever. It is expected that an overachiever at the USNA will bring a similar motivation, desire for success, and taste for the military into his/her naval career. The likelihood of him/her developing into a "careerist" is over 9 percentage points higher than the "base case." The converse case is shown on the right. This midshipman with average potential finished at the bottom of his/her USNA class, and again represents the "slacker." He/she is likely to exhibit similar performance characteristics in the fleet and thus has only a .218 probability of career success.

In summary, this model adds very little to the "Career Potential" analysis of selectivity

and human capital. Rather, the model shows us a great deal about the interaction of potential and performance. **The potential-performance interaction measures an individual's motivation and work ethic and has proven to play a very significant role in the development of career naval officers**. Neither high potential alone nor above-average performance alone, are predictors of top fleet officer performance. Yet, a great deal can be told about a URL officer and his/her probability for success in the Navy through analysis of this potential-performance motivation dynamic.

VIII. CONCLUSIONS AND RECOMMENDATIONS

This study examined the effects of pre-commissioning characteristics on the development of career naval officers. Specifically, it focused on the development of unrestricted line (URL) officers from the U.S. Naval Academy (USNA). It assessed three hypotheses for explaining the performance of USNA graduates--selectivity, human capital investment, and institutional favoritism. Additionally, various early predictors were examined for their importance in predicting the long-term career success of USNA graduates.

As its mission statement directs the USNA towards the development of career naval officers, a most applicable measure of its institutional effectiveness is its ability to produce such "careerists." In the opening chapter, a conceptual model of career naval officer development was presented (see Figure 1). The first essential step in this process is graduation from the USNA and commissioning as an Ensign in the U.S. Navy. It is hypothesized that the USNA's selectivity plays an integral role in achieving this first step, as evidenced by extensive research and personnel selection validation efforts. The next step towards a career-orientation is modeled in this study as the result of decisions by both the individual and the Navy of retention to the ten-year career point and promotion of the officer to the grade of LCDR. It is hypothesized that the USNA's selectivity, along with the extensive human capital investment associated with a midshipman's academic and professional development, and a possible institutional bias favoring USNA graduates, all play a significant role in this developmental process. Statistical modeling is employed to test the strengths of

these hypotheses. This chapter will summarize the findings, offer policy recommendations, and make recommendations for further research.

A. CONCLUSIONS

1. USNA Graduation

Graduation from the USNA is only accomplished through four years of hard work, discipline, and dedication. Beyond these ingredients, the selectivity of an individual plays an important role in his/her probability of graduation, as seen in the statistical analysis of the USNA's selection standards. Specifically, the Candidate Multiple, developed as the USNA's primary "whole-person" selection yardstick, significantly affects the likelihood of graduation in a positive manner. The primary individual predictors of the composite Candidate Multiple, associated with both cognitive and affective skills, also play a positive and significant role. Of these, the measures of cognitive skills, secondary school class rank and the Math SAT, have the greatest impacts on a midshipman's probability of graduation and taking that first step towards a naval career. While significant, these findings regarding selectivity are expected and validate the research efforts of the USNA's Office of Admissions. This study broadens this scope and looks at graduation as just one component of the potential long-term return on the Navy's investment.

2. Career Potential

a. Selectivity

The USNA's selectivity, or the relative quality of the USNA's inputs, plays a part in the development of career potential in its graduates. While the overall composite

measure appears to be insignificant, several of its individual predictors play significant roles in this process.

The selection criteria based on an individual's cognitive skills, class rank and quantitative aptitude have a negative impact on the development of career officers. This unexpected finding calls into question the validity of the USNA's emphasis on these measures. If heavy weight is given to these skills in the admissions process, this should be based on the reasonable expectation that they would increase, if anything, the probability of career success in today's technologically-advanced Navy.

In contrast, the selection criteria which represent an individual's affective and communication skills, extra-curricular activities and the Verbal SAT, significantly increase the likelihood of development into a "careerist." It is thus concluded that **such skills, which theoretically increase one's ease of assimilation into the military team environment as well as one's managerial abilities are what the Navy really needs in its URL officer corps**. While this study looked only at those who completed the technically-oriented USNA curriculum and thus have more than adequate technical aptitude, the question remains as to whether or not the USNA is selecting the truly "best." *Is the Navy missing the boat on potentially gifted leaders with 550 Math SAT's, and instead selecting future engineers with 780 SAT's and minimal inter-personal skills?*

b. Human Capital

The effect of accumulated human capital, or the relative quality of the USNA's outputs, is looked at in three different models. The first shows us that overall accumulated

human capital, as measured by the USNA's aggregate multiple, plays a significant role in an officer's career development.[56] The second and third models suggest a disparity between the effects of human capital as measured in terms of cognitive skills and affective skills. Cognitive skills are measured by academic performance in a variety of areas. Averages in strictly academic courses are negatively associated with the career potential of the USNA's graduates in the URL communities. **Among all academic areas, only grades in professional development courses, a measure of a midshipman's Navy-specific cognitive skills, improve career performance.** This finding too seems unreasonable, but nonetheless calls into question the USNA's increased emphasis on academics over the last thirty years. Further, it suggests that there is a conflict of priorities between the world of academia and the operational military.

An individual's affective skills are measured in terms of military performance grades and significant leadership or athletic experiences. **Gains in military performance significantly improve an officer's potential for career success.** This area more than any other is where differences are likely to be found in the accumulated human capital, and thus the likelihood of career success, between USNA graduates and their peers. A midshipman's four years at Annapolis are effectively a four-year apprenticeship in the Navy, which cannot be rivaled by even the most competitive ROTC or OCS program. And the empirical results

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[56] Though not a primary focus of this study, it is interesting to note the statistical insignificance of demographics, specifically minority status, in the human capital models which specify the USNA professional development process, in contrast to the significantly negative impact of minority status in the selectivity models.

of this study indicate that it is these affective skills that are most significant and essential in the development of career officers.

c. Institutional Favoritism

This study attempts to isolate a potential bias favoring USNA graduates for promotion at the O-4 board. The relationship between the USNA graduate representation of the promotion board and actual board results are explored to see whether or not USNA "ring-knockers" are promoting their own. Using simple statistical correlation methodology, no relationship was found between the level of representation by senior USNA graduates on a promotion board and the relative performance of junior URL officers from the USNA. Though no apparent trends were found, this thesis only explored the most obvious potential area of bias and the mystery or question of a potential bias still clouds the model of career officer development.

d. Early Predictors of Career Potential

In the process of analyzing the "Career Potential" models, a number of significant early predictors of fleet success stand out. First and most noteworthy, a military family background plays an obvious and significant role in molding an individual's taste, as well as his suitability, for a military career. One additional pre-USNA characteristics similarly earmarks an individual for career potential, namely the attainment of the Eagle Scout/Gold Award rank in scouting. In contrast to the virtual snapshots of ability or aptitude, measured by SAT's or high school class presidency, this accomplishment requires a sustained commitment and a desire for excellence. Beyond any measurement of aptitude, these traits

are critical to military careers and are thus expected to serve these individuals well beyond adolescence.

Similarly, USNA graduates at the top of their class have displayed a balanced and sustained commitment to excellence at the USNA. And regardless of the impact of individual areas of performance, the USNA's distinguished graduates have established the personal commitment to achievement and drive for success which therefore makes them significantly more likely to develop into career officers. The impact of the three superior performance lists are significant predictors of career development as well. Similar to distinguished graduates, Superintendent's List midshipmen have displayed outstanding performance in all areas at USNA, and are thus most likely to succeed in the fleet. While Dean's List midshipmen also are more likely to achieve career success, it is interesting to note the greater marginal effect attributed to the Commandant's List for which superior military performance and only marginally greater academic performance are required. An additional USNA achievement, independent research through the Trident Scholarship program, significantly increases an officer's career potential and perhaps indicates superior initiative in addition to analytical skills. Another USNA achievement, selection for brigade leadership rank presents similar promise as an indicator of strong fleet potential, though its statistical significance is weak. The impact of the USNA's varsity athletic program is unclear, as recruited athletes are associated with a significant increase in the "careerist" probability, yet the varsity letter-winners do not appear to be significantly related to this probability.

Finally, motivation, as determined by an analysis of the inter-relationship

between USNA potential and performance, has been proven to be an excellent predictor of career potential. Just as "over-achievers" apparently have high levels of motivation which help them to overcome limited potential and achieve an exceptionally high likelihood of career success, the opposite is true for "slackers" who despite apparently unlimited potential perform only marginally as midshipmen. **The motivation which carried them to USNA success or failure can be equally expected to increase or decrease their career potential.**

3. Summary

The empirical results of the "GRADUATION" and "CAREER POTENTIAL" analyses are summarized below. Table 8.1 below represents a synopsis of the relative impact (positive, negative, or insignificant) of the most noteworthy measures of USNA selection criteria on the likelihood of graduation from the USNA.

Table 8.1 Statistical Impact of Various Criteria on Probability of USNA Graduation.

Significant & Positive	Insignificant	Significant & Negative
Military Family	*Civilian Prep School/College (-)*	*Female*
Athletic Recruit	*High School Leadership (-)*	*Minority*
Military Prep School	*High School Athletics (-)*	*Prior-Enlisted*
Candidate Multiple		
Math SAT		
Verbal SAT		
High School Class Rank		
Teacher Recommendations		
Composite ECA's		
Eagle Scout		

Significant & Positive	Insignificant	Significant & Negative
Disenrollment Interest		

Notes: (1) All findings are significant the .10 level or greater (one-sided test).
(2) Coefficient signs are listed in parentheses for insignificant findings.

Similarly, Table 8.2 presents a synopsis of the effects of the selection and performance criteria on the likelihood of development into "careerists" for officers in the Navy's URL communities.

Table 8.2 Statistical Impact of Various Criteria on "Careerist" Probability.

Significant & Positive	Insignificant	Significant & Negative
Military Family	*Minority* (-)*	*Math SAT*
Verbal SAT	*Female (-)*	*AQPR*
Composite ECA's	*Candidate Multiple (-)*	*Academic QPR*
Eagle Scout	*High School Class Rank (-)*	
Graduation Age	*Athletic Recruit** (+/-)*	
Career Interest	*HS Leadership (+)*	
Aggregate Multiple	*HS Athletics (+)*	
MQPR	*Military Prep School (+)*	
Military Performance	*Civilian Prep School/College(-)*	
PRODEV QPR	*Prior-Enlisted (+)*	
Trident Scholar	*USNA Varsity Athlete (-)*	
	USNA Brigade Leader (+)	

Notes: (1) All findings are significant the .10 level or greater (one-tailed tests).
(2) Coefficient signs are listed in parentheses for insignificant findings.
(3) * *MINI* is significant and negative in Selectivity models.
(4) ** *RECRUIT* is significant and positive in Human Capital models.

Based on the empirical results, a final conceptual model (refining the original model in Figure 1) of the naval officer career development for USNA graduates in the URL communities is presented in Figure 15. The first step, graduation from the USNA, is impacted to a great extent by the overall selectivity--both cognitive and affective--which an individual midshipman brings with him from his adolescent years. The Whole-Person (affective and cognitive) criteria utilized in the USNA admissions process clearly meet this first step of career officer development by selecting candidates who are more likely to finish the four year USNA program and earn a commission. However, the existing selection paradigm appears to be limited in its ability to identify those candidates most likely to make the Navy a career. While an individual's cognitive skills do indirectly influence "career potential" by making him/her more likely graduate, they do not increase the probability of career success. In contrast, a midshipman's affective background skills directly and significantly impact his/her career development. **Affective skills such as cooperation, teamwork, and communication, gained through an adolescent's extra-curricular group/team experiences make the assimilation into the operational military team environment smoother and more effective.**

With regard to USNA matriculation, an individual's professional development appears critical in developing a career-minded officer. Professional development, both in Bancroft Hall and in the classroom, increase a midshipman's accumulated human capital in the areas of overall affective skills and Navy-specific cognitive skills. The Navy's human capital investment at the USNA does not in general appear to positively impact the career

development of its graduates, but these **affective skills and Navy-specific cognitive skills do play a direct and significantly positive role in the process of creating "careerists."**

The presence of and/or influence of a bias favoring USNA graduates in the Navy's promotion processes was not demonstrated through any significant statistical relationship. However, the research was able to neither prove nor disprove its existence. The result is that the question of such a bias will continue to cloud or shadow the top fleet achievement of the USNA's graduates until it is sufficiently addressed statistically.

In summary, Figure 15 indicates that selectivity and human capital investment hypotheses of USNA graduate fleet excellence are both supported to a degree, whereas no significant support for favorable institutional bias is found.

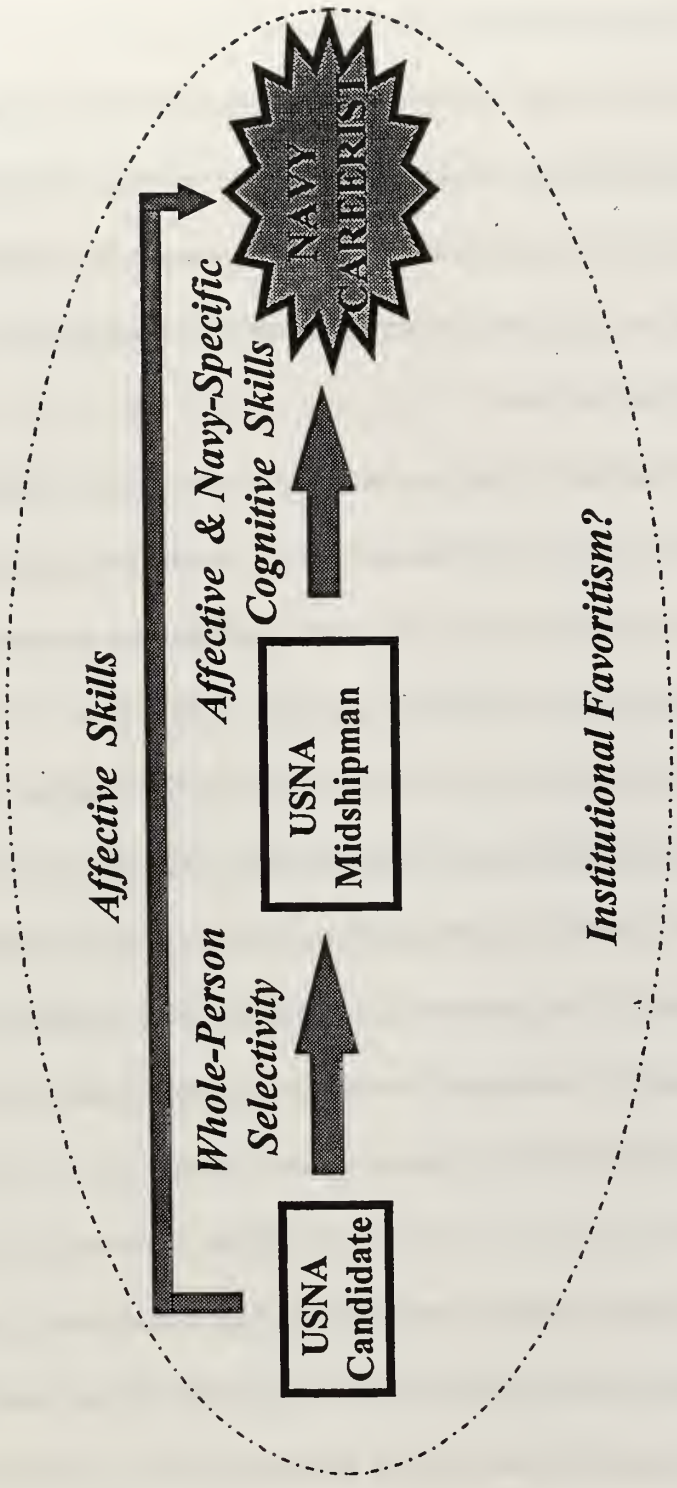

Figure 15. Final Conceptual Model Of Naval Officer Career Development

B. POLICY RECOMMENDATIONS

The results of this thesis lead the author to recommend minor modifications of the current processes, and a shift from the current short-term paradigm for selecting and training the Navy's future corps of career officers. These recommendations will first be directed to the U.S. Naval Academy itself, and then to the entire Navy organization.

1. Institutional View

From an institutional standpoint, the USNA's Admissions Office and Candidate Guidance Office stands as one of the two integral keys to the fleet success of the USNA's graduates. Though not without its faults, the admissions office does attempt to select the best and brightest "whole-person" candidates available. To better meet that objective, consideration should be given towards increasing the weights assigned to non-scholastic predictors in the Candidate Multiple. By placing almost 1/2 of the weight of the Candidate Multiple on two areas (Math SAT and secondary school class rank)--which this research shows to be associated with a decrease in the probability of career development for URL officers--the Navy may be selecting-out some potentially valuable career performers. Validation of the Candidate Multiple must begin to incorporate the "long-haul" career performance of USNA graduates. The role of the USNA's preparatory programs should additionally be broadened, building a level playing field for candidates who may have demonstrated promise for long-term careers in the Navy, but who have marginal academic backgrounds. **In short, the USNA must take its "selection for a profession, not just an education" motto to heart.**

Meanwhile, the Candidate Guidance Office appears to be adequately fulfilling its mission of attracting the best and brightest, as seen in the USNA's consistent rating by the Barron's Guide as one of the "Most Competitive" undergraduate institutions in the United States. Its ability to annually attract an incoming class with over 10 percent Eagle/Gold Award scouts, over 80 percent varsity letter-winners, and a combined mean SAT in the 1200 range stand as testimony to their success. Armed with the knowledge of the effects of the early predictors (both positive and negative) used in this study, the Candidate Guidance Office can and should better focus its recruiting efforts on those with the potential not only to graduate, but also to make a valuable impact on the Navy.

This research confirms that the second integral key to the USNA graduate performance is the coordinated effort of the Office of the Commandant and the Division of Professional Development. The impact of the new Character Development Division, which has filled a valuable void in the brigade's moral development, promises to be equally vital in this aspect of midshipmen development. By overseeing the brigade's professional development both in and out of the classroom, these offices impart the greatest Navy-specific human capital value to midshipmen. Even in an era of declining budgets, their roles and related resources should remain a priority.

Additionally, the findings regarding the apparently non-value added area of academics suggest that the USNA evaluate the relative emphasis it has placed on this area of midshipman development over the last thirty years. Clearly, the data presented herein notwithstanding, an undergraduate education (B.S. equivalent) is essential to the development

of an analytically-sound officer corps. What this thesis recommends is a **decrease in the emphasis placed upon the strictly academic portion of the USNA core curriculum**. This would involve reduced semester hours, less stringent core technical courses, less concern with the ratio of technical/non-technical majors, and a greater leniency by the Academic Board in evaluating academically-deficient midshipmen. As seen in Chapter II, small steps are being made in this area currently by the USNA leadership. Such reforms are applauded, though more can be done.

The average midshipman's priority will always be academics as long as he knows that it is his/her AQPR which, more than anything else, controls not only graduation but also service selection. Let the role of midshipman performance be heightened through the establishment and empowerment of an equally powerful Military Performance Board to evaluate the fate of professionally-deficient midshipmen, and thus increase its importance in the eyes of midshipmen. *Such small steps are necessary to ensure that the USNA's whole-person development is sufficiently broad to prepare midshipmen for the moral, mental, and physical challenges they will face during their naval careers.*

2. Organizational View

This research has a great deal of value to the United States Navy, and perhaps to its sister services as well, as it strives to develop smarter practices in the recruitment, selection, training, development, and retention of our career officer corps. While the empirical results in this study cannot be generalized beyond the sub-set of officers in the Navy's major URL communities from the USNA, obvious trends may be applicable. Improved practices are

especially vital today in an era of increasing operational requirements and ever-decreasing budgets.

Ideally, stressing the whole-person philosophy across all commissioning sources will help the Navy pick its future leaders. **The Navy can not afford to pass up less-technically inclined or less-scholastically gifted high school students who possess the very attributes of leadership, initiative, cooperation, motivation, and perseverance which increase their likelihood of developing into successful career officers.**

In order to execute the "Whole-Person" philosophy effectively, the other commissioning sources and services should follow the USNA's lead in the creation of a "Whole-Person multiple." But as seen in this thesis, in order to achieve a worthwhile return on the Navy's extensive training and educational investments, such a multiple should be weighted towards those areas which increase an individual's long-term officer potential. These selection tools must be validated not only with pre-commissioning data such as graduation, but also with actual post-commissioning data such as retention and promotion.

A longer-term approach to officer selection and development is clearly needed. The Navy may not earn an adequate return on its $200,000 USNA investment or $100,000 NROTC scholarship by selecting and graduating students who will serve the Navy for their minimum service requirement and then separate. **As life-cycle management is emphasized in defense weapon system acquisition management, so should management for the long-haul be the aim of the Navy and its sister services in the selection and training of the professional officer corps.**

C. RECOMMENDATIONS FOR FURTHER RESEARCH

By limiting this study to USNA graduates in the URL, less than one third of the Navy's 1980 to 1985 URL officer cohort was examined. Attempts should be made to obtain comparable selection and college background data from the Navy's ROTC programs to further the officer career development research effort.

Despite the wealth of data available in the new USNA database constructed for this study, inherent data restrictions ought to be explored and potentially included in the database. First, in the analysis of USNA graduation, distinguishing between voluntary and involuntary resignations from the USNA was not possible with this cohort, and may provide further insight into the USNA matriculation process. Second, post-commissioning data was limited to USNA graduates in the major URL communities--only 2/3 of the total graduates from the USNA Classes of 1980 through 1985 and just over 4/5 of the graduates commissioned as Ensigns in the U.S. Navy. While URL officers remain the focus of the USNA's output, a total of 956 Navy officers are lost between graduation due to their selection into the non-URL communities or leaving the Navy in the first four years of commissioned service. Accounting for these officers and including them in the database may increase this study's applicability to all USNA graduates.

A potential limitation of this study is its assumption that officers who stay to the ten-year point and are selected for promotion to LCDR are in fact "careerists." The potential certainly exists for both voluntary and involuntary separation from the officer corps between

the ten-year and twenty-year points. Additionally, an individual's propensity to stay is probably not necessarily influenced by the same factors that influence his promotability. Therefore, additional research with this data set is recommended to further study the retention and promotion decisions.

Continued research with this data set may also present the USNA and the Navy with more concrete policy recommendations. For example, the use of optimization software to develop a linear programming model of retention by years of service from the individual admissions predictors may yield a more valuable long-term Candidate Multiple, and may help the Navy to optimize its training investments.

Finally, this data set presents several other research opportunities for labor economics or sociology researchers wishing to study military officers. Future studies might concentrate solely on demographics, solely on selectivity, or solely on athletics, as more recent cohorts of USNA graduates may present alternative explanatory data such as socioeconomic background and physical aptitude. Alternative officer performance metrics could be utilized. In addition, the data could be used to analyze later points in an officer's career. This study has shown us what factors are significant at the ten-year point of an officer's career, but perhaps an estimation of similar models may present dramatically different findings at the Commander, Captain, and Flag level. For example, varsity letter-winners or brigade leaders, statistically insignificant in this study, may not stand out significantly from their peers until the O-6 career stage. Conversely perhaps significant factors in this study such as USNA military performance may be of little value in the selection of Flag officers. This study only begins to

realize the value of the USNA database and the potential of such long-term career analyses to positively influence the shape of the Navy's professional officer corps.

APPENDIX A. USNA PROFESSIONAL DEVELOPMENT

The following is a description of the year-by-year breakdown of the USNA's professional development program, designed to develop midshipmen "morally, mentally, and physically for careers in the Naval Service." Sources for this summary include USNA Catalogs (1980, 1996), Reef Points (1987), the USNA and Majors Program (1980-1985) matrix, and curriculum information obtained via the Internet at the USNA Homepage.

A. FOURTH CLASS (OR PLEBE) YEAR

The Fourth Class year is divided into Plebe Summer and an equally demanding academic year. The intense seven-week plebe summer, with its frantic, exhaustive pace, is designed to quickly bridge the gap between civilian life (or previous military service) and life as a midshipman. The plebe indoctrination program, lead by first-class midshipmen and brigade officers, has a three-fold process: to instill discipline, to develop leadership qualities, and to introduce plebes to the nautical and military aspects of a career in the Naval service.

Plebes begin each day before dawn and end their days long after sunset with no free time in between--thereby learning self-discipline, time and personal management, physical conditioning, and the ability to think clearly under stress. During this summer, plebes are trained in infantry drill, sailing, small arms marksmanship, signaling, basic seamanship, integrity and the Honor Concept, rote memorization of naval traditions and rates, and physical conditioning.

The plebe academic year includes further military training by upperclass midshipmen

with an emphasis on rote memorization of Navy ships and aircraft, allied capabilities, and joint missions, in addition to a demanding academic workload which includes the following professional courses and training:

- Three professional classes: Naval science (including at-sea labs on Yard Patrol craft and Combat Information Center (CIC) and Bridge simulators), fundamentals of leadership, and naval history;
- 3 weekly hours of infantry drill, including Brigade of Midshipmen dress parades;
- Physical Education - 4 graded semester (non-credit) hours of swimming, weight training, and lifetime fitness, in addition to mandatory varsity or intramural athletics and semi-annual fitness tests (1.5-mile run, obstacle course, and applied strength tests).

B. THIRD-CLASS (OR YOUNGSTER) YEAR

Following the rigors of plebe year, newly "striped" third-class midshipmen will conduct Atlantic training patrols in Yard Patrol craft or sail up and down the eastern seaboard on training sloops. These "Youngster Cruises" are conducted with classmates under the supervision of officers from the Division of Professional Development, and are designed to give midshipmen hands-on ship handling and practical leadership experience. Additionally, youngsters spend three weeks of Naval Tactical Training, which includes indoctrination with the Marine Corps in Quantico, VA, land navigation, and SEAL training, as well as orientation training in the joint arena of the Pentagon, Army, and Air Force, and Coast Guard.

Third-class academic year includes the following professional courses and training:

- Three required classes, including navigation and piloting, naval engineering, and

ethics and moral reasoning. This final class includes formal ethics and theory lecture by philosophers, small group discussion facilitated by senior officers, and weekly case analyses involving real military scenarios;

- 3 weekly hours of infantry drill, including Brigade of Midshipmen dress parades;
- Physical Education - 4 graded semester (non-credit) hours of swimming and lifesaving, boxing, and wrestling, in addition to mandatory varsity or intramural athletics and semi- annual fitness tests (1.5-mile run, obstacle course, and applied strength tests).

C. SECOND-CLASS YEAR

Midshipmen spend the summer before second-class year experiencing every major branch of the Navy. This includes aviation and flight training at Pensacola, nuclear-powered submarine training off the coast of Florida, and additional Marine Corps training in Quantico. Additionally, midshipmen report for four weeks of duty onboard Navy ships or submarines - their first fleet experience. Midshipmen take part in exercises, stand watches, and receive indoctrination in the actual shipboard life of the Operations, Engineering, and Weapons departments, working with a senior enlisted (E-6 to E-8) running mate. The experience is designed to give midshipmen first-hand knowledge of the Navy at-sea and an appreciation for the talents, responsibilities, and perspectives of the enlisted men and women whom they will lead in the future.

The second class academic year is generally acknowledged as the most demanding year, in terms of academics, individual training of fourth-class midshipmen, and their own professional training. The year includes the following professional training:

- Five required classes: naval strategy and tactics, an advanced naval engineering

course, naval electricity and electronics, naval weapons systems, and a leadership course emphasizing management techniques, problem-solving, decision making, and subordinate development. This is accomplished with both theory and practice, often involving midshipmen and company NCO's in role-playing exercises in an effort to prepare them for situations they might face as junior officers;

- 3 weekly hours of infantry drill, including Brigade of Midshipmen dress parades;
- Physical Education - 4 graded semester (non-credit) hours of swimming and lifesaving, and judo, in addition to mandatory varsity or intramural athletics and semi-annual fitness tests (1.5-mile run, obstacle course, and applied strength tests).

D. FIRST-CLASS YEAR

First-class summer offers midshipmen the opportunity to put leadership skills to the test, both in the fleet and at the Academy with the new Plebes. Midshipmen spend up to eight weeks with an operational Navy or Marine Corps unit, and assume the duties of a junior officer. Depending upon their career interests, they select from surface warships, submarine, aircraft carriers or squadrons, or an intense "Bulldog" officer candidate course and follow-on tour attached to a Marine Corps unit. Additional opportunities include various internships and plebe indoctrination.

After assuming leadership for the brigade, the first-class midshipmen are faced with more responsibilities, as well as privileges, as they prepare for their roles as junior officers in the Navy or Marine Corps. Additional first-class military training includes the following:

- Three required classes, including a advanced weapons course exploring warfare systems design, a law course covering military justice and the law of war, and a junior officer practicum designed and tailored to serve as a capstone course for the warfare specialty selected;

- 3 weekly hours of infantry drill, including Brigade of Midshipmen dress parades;

- Physical Education - 4 graded semester (non-credit) hours of swimming and lifesaving, hand-to-hand combat and an elective recreational sport, in addition to mandatory varsity or intramural athletics and semi-annual fitness tests (1.5-mile run, obstacle course, and applied strength tests).

APPENDIX B. CHARACTERISTICS OF USNA GRADUATES

Table B.1 Means/Proportions of Entire USNA Graduate Population (Classes 1980-1985)

Variable	ALL GRADS	URL (O-3) GRADS	OTHER NAVY GRADS	USMC GRADS	OTHER GRADS
GRAD (n)	6017	4095	956	918	48
MIN1	.115	.107	.061	.147	.250
FEMALE1	.061	.017	.201	.041	.021
GRADAGE	22.48	22.44	22.58	22.58	22.25
MILFAM	.196	.205	.177	.168	.417
RECRUIT	.250	.238	.274	.285	.125
PRIORNOM	.046	.136	.062	.088	0
CIVPREP	.203	.207	.195	.191	.250
MILPREP	.201	.183	.211	.271	.208
CM	63439.5	63663.2	63518.9	62373.9	63057.5
SATMHI	666.2	672.0	659.1	648.1	664.4
SATVHI	577.0	579.3	577.3	566.4	577.0
RC	585.7	589.3	597.5	558.8	558.9
RECS	864.1	860.6	872.5	871.3	855.1
COMPECA	527.7	526.1	531.1	531.0	540.1
CIS	523.4	526.4	517.6	517.0	550.9
NUMBER1	.046	.017	.056	.088	.021
TOPHSAT	.083	.090	.075	.062	.062
ATHLETE	.191	.377	.090	.046	.396
EAGLE	.117	.126	.086	.110	.167
LEADER	.555	.540	.586	.588	.562
AGGMULT	1027.4	1039.1	1022.9	982.7	974.6

Variable	ALL GRADS	URL (O-3) GRADS	OTHER NAVY GRADS	USMC GRADS	OTHER GRADS
AQPR	2.784	2.823	2.775	2.626	2.626
MQPR	3.064	3.087	3.025	3.004	2.946
ACADQPR	2.784	2.777	2.741	2.582	2.585
PRDVQPR	2.994	3.040	2.994	2.836	2.831
PERFQPR	3.160	3.173	3.126	3.147	3.003
CONDQPR	3.758	3.761	3.757	3.758	3.718
GRI	.170	.429	.277	.250	.187
GRII	.434	.106	.475	.501	.646
GRIII	.106	.183	.245	.250	.167
STRIPER	.106	.106	.086	.134	.062
TRIDENT	.005	.005	.106	.003	0
NLETTER	.142	.134	.183	.106	.062
HONORG	.101	.183	.092	.092	.042
CLASS80	.155	.165	.142	.170	.155
CLASS81	.101	.174	.145	.125	.160
CLASS82	.174	.179	.165	.145	.396
CLASS83	.177	.171	.190	.101	.125
CLASS84	.101	.156	.179	.106	.229
CLASS80	.171	.165	.182	.187	.167

Notes: (1) Please refer to Figure 2 in the text for a full explanation of the categories.
(2) "Other Navy Grads" includes both non-URL officers and URL officers separated from the Navy in the first 4 years of service.
(3) "Other Grads" includes graduates commissioned in the USAF or USA, and any graduates not commissioned for medical or other reasons.

APPENDIX C. CHARACTERISTICS OF URL OFFICERS

Table C.1 Means/Proportions of Entire USNA Graduate Population (Classes 1980-1985)

Variable	ALL URL (O-3)	"CAREER-ISTS"	"LEAVERS"	LATERAL TRANSFER	"NON-PROM"
GRAD (n)	4095	1466	2042	164	423
MIN1	.107	.086	.106	.128	.116
FEMALE1	.017	.006	.268	.067	.021
GRADAGE	22.44	22.54	22.58	22.40	22.25
MILFAM	.205	.245	.177	.262	.417
RECRUIT	.038	.243	.274	.177	.125
PRIORNOM	.038	.041	.032	.037	.057
CIVPREP	.207	.220	.199	.232	.187
MILPREP	.183	.191	.177	.201	.215
CM	63663.2	63596.5	63696.7	64169.8	63537.8
SATMHI	672.0	669.1	673.0	675.9	675.2
SATVHI	579.3	579.2	579.3	580.8	578.9
RC	589.3	584.5	592.2	607.4	584.6
RECS	860.6	861.8	860.5	864.7	855.5
COMPECA	526.1	532.8	523.6	517.8	517.6
CIS	526.4	529.1	522.3	535.6	533.8
NUMBER1	.037	.051	.033	.055	.031
TOPHSAT	.090	.083	.094	.110	.088
ATHLETE	.377	.394	.375	.396	.326
EAGLE	.126	.156	.107	.098	.121
LEADER	.540	.553	.533	.549	.520
AGGMULT	1039.1	1055.6	1038.4	1043.6	983.6

Variable	ALL URL (O-3)	"CAREER-ISTS"	"LEAVERS"	LATERAL TRANSFER	"NON-PROM"
AQPR	2.823	2.859	2.824	2.847	2.681
MQPR	3.087	3.149	3.074	3.088	2.938
ACADQPR	2.777	2.811	2.782	2.808	2.628
PRDVQPR	3.040	3.085	3.030	3.035	2.938
PERFQPR	3.173	3.284	3.146	3.182	2.910
CONDQPR	3.761	3.786	3.749	3.798	3.720
GRI	.429	.444	.418	.421	.435
GRII	.005	.444	.411	.451	.109
GRIII	.164	.162	.146	.128	.156
STRIPER	.108	.134	.102	.110	.031
TRIDENT	.005	.136	.003	.012	0
NLETTER	.134	.136	.138	.146	.154
HONORG	.113	.144	.103	.110	.052
CLASS80	.165	.156	.146	.226	.154
CLASS81	.174	.191	.170	.177	.130
CLASS81	.175	.165	.171	.177	.161
CLASS83	.174	.175	.164	.165	.192
CLASS80	.156	.128	.171	.122	.189
CLASS85	.165	.156	.172	.134	.175
SWO	.301	.239	.324	.683	.262
NSWO	.042	.036	.054	.012	.021
SUB	.250	.239	.292	.104	.144
PILOT	.244	.282	.214	.085	.322
NFO	.161	.203	.117	.116	.251

Variable	ALL URL (O-3)	"CAREER-ISTS"	"LEAVERS"	LATERAL TRANSFER	"NON-PROM"
SNC	.542	.522	.549	.549	.579
SWC	.004	.003	.005	0	0
MNC	.365	.376	.364	.390	.324
MWC	.090	.093	.082	.079	.097

Notes: (1) Please refer to Figure 7 in the text for a full explanation of the categories.
(2) "Leavers" includes all URL officers who left active duty between the O-3 and O-4 promotion boards.
(3) "Lateral Transfer" includes all URL officers who transferred into a non-URL community between the O-3 and O-4 promotion boards.
(4) "Non-Prom" includes all URL officers at the O-4 promotion board who were not promoted.

APPENDIX D. CAREER POTENTIAL ANALYSIS OF "SWO" SUB-SAMPLE

Table D.1 Means/Proportions for the Surface Warfare Officer (SWO) Sub-Sample Variables (n = 1408)

Variable	Means	Variable	Means
GRAD	1.00	**LEADER**	.537
NAVYURL	1.00	**AGGMULT**	984.6
MIN1	.157	**AQPR**	2.657
FEMALE1	.020	**MQPR**	2.956
GRADAGE	22.50	**ACADQPR**	2.608
MILFAM	.203	**PRDVQPR**	2.889
RECRUIT	.255	**PERFQPR**	3.003
PRIORNOM	.045	**CONDQPR**	3.710
CIVPREP	.197	**GRI**	.332
MILPREP	.214	**GRII**	.447
CM	62,985.9	**GRIII**	.205
SATMHI	661.5	**STRIPER**	.081
SATVHI	575.7	**TRIDENT**	.002
RC	576.7	**NLETTER**	.122
RECS	861.3	**HONORG**	.062
COMPECA	524.0	**CLASS80**	.132
CIS	523.6	**CLASS81**	.165
NUMBER1	.038	**CLASS82**	.180
TOPHSAT	.075	**CLASS83**	.144
ATHLETE	.373	**CLASS84**	.173
EAGLE	.122	**CLASS85**	.206

Variable	Means	Variable	Means
SWO	1.00	**MNC**	.330
NSWO	.122	**MWC**	.071
SNC	.594	**STAYER**	.448
SWC	.006	**CAREER**	.283

Table D.2 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Selectivity Models of Career Potential for SWO Sub-Sample (Dependent Variable = CAREER)

	Model One	Model Two
INTERCEPT	-0.7371	-0.6879
MIN1	-0.1643	-0.2129
FEMALE1	-0.2677	-0.1310
MILFAM	0.2665**	0.2648**
PRIORNOM	-0.1168	-0.1037
RECRUIT	0.1539	0.1206
CIVPREP	-0.0180	-0.0240
MILPREP	0.1981	0.0506
GRADAGE	0.0117	0.00894
CM	-0.00001	--
SATMHI	--	-0.00285***
SATVHI	--	0.00107
RC	--	-0.00143**
RECS	--	0.000283
COMPECA	--	0.000975
CIS	--	0.00133**
EAGLE	--	0.2027
LEADER	--	0.2621**
ATHLETE	--	-0.0805
CLASS81	0.2836*	0.2047
CLASS82	0.2893*	0.2236
CLASS83	-0.0114	-0.0859

	Model One	Model Two
CLASS84	-0.1985	-0.2999
CLASS85	-0.0688	-0.1151
NSWO	0.1406	0.1742
MNC	0.0105	-0.0652
MWC	0.1861	0.1582
Concordance Ratio	0.576	0.617
-2 LOG L	20.570	44.950
Sample Size	1396	1363

Notes:
(1) *SWC* deleted from model due to low frequency and resulting model spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

Table D.3 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Human Capital Models of Career Potential for SWO Sub-Sample
(Dependent Variable = CAREER)

	Model One	Model Two	Model Three
INTERCEPT	-2.3195***	-3.2227***	-2.5818***
MIN1	-0.0579	-0.0648	-0.0672
FEMALE1	-0.3809	-0.4661	-0.5382
MILFAM	0.2710**	0.3181**	0.3171**
PRIORNOM	-0.0986	-0.1534	-0.1511
RECRUIT	0.2154*	0.1675	0.1618
CIVPREP	-0.00969	-0.0391	-0.0319
MILPREP	0.2879**	0.2304*	0.2127*
GRADAGE	0.0120	0.0145	0.0154
AGGMULT	0.000939**	--	--
AQPR	--	-0.5887***	--
MQPR	--	1.1345***	--
ACADQPR	--	--	-0.3687*
PRDVQPR	--	--	0.0194
PERFQPR	--	--	0.6518***
CONDQPR	--	--	0.0114
GRI	--	-0.0258	0.0293
GRIII	--	0.2565*	0.2279*
STRIPER	--	0.1831	0.0912
NLETTER	--	0.0826	0.1387
CLASS81	0.2502	0.1923	0.2065
CLASS82	0.2780*	0.2142	0.2309

	Model One	Model Two	Model Three
CLASS83	-0.0131	-0.1115	-0.0744
CLASS84	-0.2041	-0.3287*	-0.2864
CLASS85	-0.1066	-0.2280	-0.1615
NSWO	-0.0381	0.00896	0.0167
MNC	0.0320	0.0153	-0.0134
MWC	0.2127	0.1252	0.1251
Concordance Ratio	0.585	0.610	0.615
-2 LOG L	23.121	45.352	52.976
Sample Size	1383	1396	1396

Notes:
(1) *SWC* and *TRIDENT* deleted from models due to low frequencies and resulting spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

APPENDIX E. CAREER POTENTIAL ANALYSIS OF "SUB" SUB-SAMPLE

Table E.1 Means and Proportions for the Submarine Officer (SUB) Sub-Sample Variables (n = 1025)

Variable	Means	Variable	Means
GRAD	1.00	**AGGMULT**	1140.3
NAVYURL	1.00	**AQPR**	3.135
MIN1	.057	**MQPR**	3.281
GRADAGE	22.30	**ACADQPR**	3.102
MILFAM	.184	**PRDVQPR**	3.301
RECRUIT	.172	**PERFQPR**	3.389
PRIORNOM	.036	**CONDQPR**	3.826
CIVPREP	.214	**GRI**	.604
MILPREP	.098	**GRII**	.294
CM	65,542.7	**GRIII**	.098
SATMHI	702.4	**STRIPER**	.164
SATVHI	596.8	**TRIDENT**	.015
RC	632.7	**NLETTER**	.099
RECS	853.4	**HONORG**	.246
COMPECA	518.8	**CLASS80**	.173
CIS	541.4	**CLASS81**	.196
NUMBER1	.086	**CLASS82**	.177
TOPHSAT	.158	**CLASS83**	.204
ATHLETE	.321	**CLASS84**	.138
EAGLE	.134	**CLASS85**	.112
SUB	1.00	**SNC**	.512

Variable	Means	Variable	Means
LEADER	.553	**SWC**	.002
MNC	.379	**STAYER**	.419
MWC	.107	**CAREER**	.342

Table E.2 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Selectivity Models of Career Potential for SUB Sub-Sample (Dependent Variable = CAREER)

	Model One	Model Two
INTERCEPT	-3.5445**	-4.0209**
MIN1	-0.5570**	-0.5249*
MILFAM	0.4656***	0.4919***
PRIORNOM	-0.0563	0.0349
RECRUIT	0.2543*	0.1902
CIVPREP	0.0345	0.0375
MILPREP	0.1513	0.1684
GRADAGE	0.0457	0.0423
CM	0.000025	--
SATMHI	--	0.000262
SATVHI	--	0.000569
RC	--	0.000216
RECS	--	-0.00031
COMPECA	--	0.00166*
CIS	--	0.00162**
EAGLE	--	0.4511**
LEADER	--	-0.0862
ATHLETE	--	0.1070
CLASS81	0.2209	0.2017
CLASS82	0.1640	0.1397
CLASS83	0.3838**	0.3708*
CLASS84	-0.1349	-0.0840

	Model One	Model Two
CLASS85	-0.1298	-0.1453
MNC	0.0189	0.0358
MWC	-0.0893	-0.1351
Concordance Ratio	0.593	0.613
-2 LOG L	23.071	34.502
Sample Size	1015	995

Notes:
(1) *SWC* deleted from models due to low frequency and resulting spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

Table E.3 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Human Capital Models of Career Potential for SUB Sub-Sample
(Dependent Variable = CAREER)

	Model One	Model Two	Model Three
INTERCEPT	-5.2209***	-6.2078***	-6.6057***
MIN1	-0.3820	-0.3652	-0.3684
MILFAM	0.4942***	0.5165***	0.5264***
PRIORNOM	0.00572	-0.0126	0.0251
RECRUIT	0.2973**	0.3059*	0.3300**
CIVPREP	-0.0135	-0.0279	-0.0334
MILPREP	0.2178	0.2275	0.2087
GRADAGE	0.0468	0.0395	0.0409
AGGMULT	0.00291***	--	--
AQPR	--	0.2907	--
MQPR	--	1.0560***	--
ACADQPR	--	--	0.2600
PRDVQPR	--	--	0.3703
PERFQPR	--	--	0.5051***
CONDQPR	--	--	0.2522
GRI	--	0.1934	0.2152*
GRII	--	-0.1058	-0.1371
STRIPER	--	-0.0690	-0.1028
NLETTER	--	-0.0304	-0.00120
CLASS81	0.1314	0.1934	0.1644
CLASS82	0.0413	0.0232	0.0506
CLASS83	0.3824**	0.3583*	0.3964**

	Model One	Model Two	Model Three
CLASS84	-0.2190	-0.2467	0.2258
CLASS85	-0.2193	-0.2824	-0.2373
MNC	0.0165	0.00643	0.00206
MWC	-0.1076	-0.1323	-0.1351
Concordance Ratio	0.629	0.641	0.645
-2 LOG L	47.130	56.059	59.405
Sample Size	1016	1017	1017

Notes:
(1) *SWC* and *TRIDENT* deleted from models due to low frequencies and resulting spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

APPENDIX F. CAREER POTENTIAL ANALYSIS OF "PILOT" SUB-SAMPLE

Table F.1 Means and Proportions for the Pilot (PILOT) Sub-Sample Variables (n = 1001)

Variable	Means	Variable	Means
GRAD	1.00	**LEADER**	.542
NAVYURL	1.00	**AGGMULT**	1016.7
MIN1	.066	**AQPR**	2.737
FEMALE1	.021	**MQPR**	3.056
GRADAGE	22.52	**ACADQPR**	2.685
MILFAM	.224	**PRDVQPR**	2.972
RECRUIT	.288	**PERFQPR**	3.146
PRIORNOM	.029	**CONDQPR**	3.719
CIVPREP	.214	**GRI**	.403
MILPREP	.221	**GRII**	.432
CM	62,834.9	**GRIII**	.157
SATMHI	659.7	**STRIPER**	.094
SATVHI	566.4	**TRIDENT**	.002
RC	565.1	**NLETTER**	.183
RECS	868.2	**HONORG**	.070
COMPECA	533.9	**CLASS80**	.155
CIS	516.7	**CLASS81**	.174
NUMBER1	.029	**CLASS82**	.184
TOPHSAT	.005	**CLASS83**	.161
ATHLETE	.419	**CLASS84**	.157

Variable	Means	Variable	Means
EAGLE	.107	**CLASS85**	.168
PILOT	1.00	**MWC**	.113
SNC	.497	**STAYER**	.562
SWC	.002	**CAREER**	.415
MNC	.395		

Table F.2 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Selectivity Models of Career Potential for PILOT Sub-Sample (Dependent Variable = CAREER)

	Model One	Model Two
INTERCEPT	-1.7279	-2.8280*
MIN1	-0.3658*	-0.2657
FEMALE1	0.1725	0.0282
MILFAM	0.3578**	0.3767**
PRIORNOM	-0.0115	0.1678
RECRUIT	-0.2598*	-0.3718**
CIVPREP	0.0609	0.0677
MILPREP	-0.1811	-0.1956
GRADAGE	0.0744	0.0698
CM	-0.00000273	--
SATMHI	--	-0.00024
SATVHI	--	-0.00083
RC	--	0.000468
RECS	--	0.000304
COMPECA	--	0.00276***
CIS	--	-0.00041
EAGLE	--	0.2064
LEADER	--	-0.1387
ATHLETE	--	0.0733
CLASS81	-0.2149	-0.2624
CLASS82	-0.0112	-0.0835
CLASS83	-0.3730*	-0.4877**

	Model One	Model Two
CLASS84	-0.4487**	-0.5436**
CLASS85	0.0525	-0.0572
MNC	0.1141	0.0883
MWC	0.2244	0.1943
Concordance Ratio	0.584	0.594
-2 LOG L	24.152	34.197
Sample Size	991	980

Notes:
(1) *SWC* deleted from model due to low frequency and resulting model spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

Table F.3 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Human Capital Models of Career Potential for PILOT Sub-Sample
(Dependent Variable = CAREER)

	Model One	Model Two	Model Three
INTERCEPT	-3.6116**	-4.0282**	-3.3668**
MIN1	-0.2355	-0.1801	-0.2077
FEMALE1	0.1870	0.1512	0.1318
MILFAM	0.3680**	0.3664**	0.3854***
PRIORNOM	-0.1059	-0.1881	-0.1679
RECRUIT	-0.1797	-0.1201	-0.1159
CIVPREP	0.0703	0.0167	0.00514
MILPREP	-0.1308	-0.0912	-0.0806
GRADAGE	0.0868	0.0793	0.0749
AGGMULT	0.00140***	--	--
AQPR	--	-0.1638	--
MQPR	--	0.7761***	--
ACADQPR	--	--	-0.2398
PRDVQPR	--	--	0.3229
PERFQPR	--	--	0.5129***
CONDQPR	--	--	-0.1730
GR[redacted]	--	0.1525	0.1480
GRIII	--	0.0841	0.0175
STRIPER	--	0.5063**	0.4316**
NLETTER	--	-0.0970	-0.0827
CLASS81	-0.2390	-0.2494	-0.2069
CLASS82	-0.0647	-0.0934	-0.00986

	Model One	Model Two	Model Three
CLASS83	-0.4164**	-0.4664**	-0.3507*
CLASS84	-0.4707**	-0.5368**	-0.4376**
CLASS85	0.00956	-0.0646	0.0353
MNC	0.1229	0.1247	0.1221
MWC	0.2329	0.2406	0.2438
Concordance Ratio	0.600	0.608	0.624
-2 LOG L	30.888	47.647	52.840
Sample Size	987	991	991

Notes:
(1) *SWC* and *TRIDENT* deleted from models due to low frequencies and resulting spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

APPENDIX G. CAREER POTENTIAL ANALYSIS OF "NFO" SUB-SAMPLE

Table G.1 Means and Proportions for the Naval Flight Officer (NFO) Sub-Sample Variables (n = 661)

Variable	Means	Variable	Means
GRAD	1.00	**LEADER**	.518
NAVYURL	1.00	**AGGMULT**	1031.3
MIN1	.106	**AQPR**	2.778
FEMALE1	.030	**MQPR**	3.077
GRADAGE	22.40	**ACADQPR**	2.730
MILFAM	.216	**PRDVQPR**	3.005
RECRUIT	.217	**PERFQPR**	3.174
PRIORNOM	.042	**CONDQPR**	3.760
CIVPREP	.210	**GRI**	.385
MILPREP	.193	**GRII**	.427
CM	63,370.3	**GRIII**	.180
SATMHI	667.3	**STRIPER**	.094
SATVHI	578.4	**TRIDENT**	0
RC	582.2	**NLETTER**	.135
RECS	860.5	**HONORG**	.073
COMPECA	530.2	**CLASS80**	.168
CIS	525.2	**CLASS81**	.159
NUMBER1	.036	**CLASS82**	.172
TOPHSAT	.072	**CLASS83**	.190
ATHLETE	.401	**CLASS84**	.168

Variable	Means	Variable	Means
EAGLE	.148	**CLASS85**	.144
PILOT	1.00	**MWC**	.079
SNC	.540	**STAYER**	.639
SWC	.004	**CAREER**	.448
MNC	.376		

Table G.2 Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Selectivity Models of Career Potential for NFO Sub-Sample (Dependent Variable = CAREER)

	Model One	Model Two
INTERCEPT	-6.4303*	-7.5918**
MIN1	-0.1818	-0.0191
FEMALE1	-0.2802	-0.3314
MILFAM	0.5453***	0.5372***
PRIORNOM	0.1515	0.3147
RECRUIT	0.0444	0.0800
CIVPREP	-0.0960	-0.0524
MILPREP	-0.4090*	-0.3024
GRADAGE	0.3300**	0.2376*
CM	-0.00002	--
SATMHI	--	-0.00052
SATVHI	--	0.00209*
RC	--	-0.00033
RECS	--	-0.00033
COMPECA	--	0.00345***
CIS	--	0.00022
EAGLE	--	0.5248**
LEADER	--	-0.3528**
ATHLETE	--	-0.0363
CLASS81	0.5784**	0.4268*
CLASS82	0.1886	-0.00117
CLASS83	0.1864	-0.00378

	Model One	Model Two
CLASS84	-0.1521	-0.2528
CLASS85	0.0875	-0.0404
MNC	0.1185	0.1087
MWC	0.2189	0.1995
Concordance Ratio	0.607	0.634
-2 LOG L	25.780	37.889
Sample Size	655	642

Notes:
(1) *SWC* deleted from model due to low frequency and resulting model spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

Estimated LOGIT β Parameter Coefficients of Explanatory Variables in Human Capital Models of Career Potential for NFO Sub-Sample
(Dependent Variable = CAREER)

	Model One	Model Two	Model Three
INTERCEPT	-10.1825***	-13.1245***	-12.7481***
MIN1	-0.00914	-0.00215	0.0186
FEMALE1	-0.2079	-0.5596	-0.6385
MILFAM	0.5507***	0.4733**	0.4660**
PRIORNOM	0.0356	0.00151	-0.0754
RECRUIT	0.2011	0.1224	0.1926
CIVPREP	-0.1052	-0.1014	-0.1301
MILPREP	-0.2780	-0.3498*	-0.3403
GRADAGE	0.3651**	0.3860**	0.3905**
AGGMULT	0.00156***	--	--
AQPR	--	-0.8046***	--
MQPR	--	2.1627***	--
ACADQPR	--	--	-0.8988***
PRDVQPR	--	--	1.0056***
PERFQPR	--	--	0.8562***
CONDQPR	--	--	0.1538
GRI	--	-0.3241**	-0.3517**
GRIII	--	-0.1906	-0.2536
STRIPER	--	-0.2309	-0.2107
NLETTER	--	0.0529	0.0399
CLASS81	0.4787**	0.4013*	0.3801*
CLASS82	0.0648	-0.1156	0.0153

	Model One	Model Two	Model Three
CLASS83	0.1007	-0.0334	0.1686
CLASS84	-0.2718	-0.5045**	-0.3933
CLASS85	-0.1104	-0.3309	-0.1696
MNC	0.1240	0.1498	0.1307
MWC	0.2835	0.2910	0.2482
Concordance Ratio	0.613	0.658	0.669
-2 LOG L	29.749	59.934	66.398
Sample Size	651	655	655

Notes:
(1) *SWC* and *TRIDENT* deleted from models due to low frequencies and resulting spec errors.
(2) *** Significant at the .01 Level (one-tailed tests)
** Significant at the .05 Level (one-tailed tests)
* Significant at the .10 Level (one-tailed tests)

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